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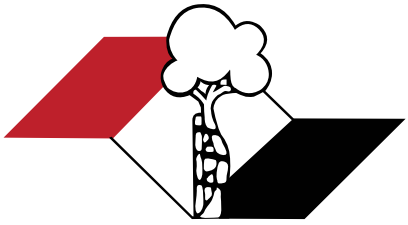

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ACTA ORTOPÉDICA BRASILEIRA

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(Reviewed April 2022)

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ACKNOWLEDGEMENTS

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LEVELS OF EVIDENCE FOR PRIMARY RESEARCH QUESTION: Access the following link.

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Levels of Evidence for Primary Research Question[a]

(This chart was adapted from material published by the Centre for Evidence-Based Medicine, Oxford, UK. For more information, please visit www.cebm.net.)

	Types of study			
Level	**Therapeutic Studies Investigating the Results of Treatment**	**Prognostic Studies – Investigating the Effect of a Patient Characteristic on the Outcome of Disease**	**Diagnostic Studies – Investigating a Diagnostic Test**	**Economic and Decision Analyses – Developing an Economic or Decision Model**
I	High quality randomized trial with statistically significant difference or no statistically significant difference but narrow confidence intervals	High quality prospective study[d] (all patients were enrolled at the same point in their disease with ≥80% of enrolled patients)	Testing of previously developed diagnostic criteria on consecutive patients (with universally applied reference ''gold'' standard)	Sensible costs and alternatives; values obtained from many studies; with multiway sensitivity analyses
	Systematic review[b] of Level RCTs (and study results were homogenous[c])	Systematic review[b] of Level I studies	Systematic review[b] of Level I studies	Systematic review[b] of Level I studies
II	Lesser quality RCT (eg, < 80% followup, no blinding, or improper randomization)	Retrospective[f] study	Development of diagnostic criteria on consecutive patients (with universally applied reference ''gold'' standard)	Sensible costs and alternatives; values obtained from limited studies; with multiway sensitivity analyses
	Prospective[d] comparative study[e]	Untreated controls from an RCT	Systematic review[b] of Level II studies	Systematic review[b] of Level II studies
	Systematic review[b] of Level II studies or Level I studies with inconsis tent results	Lesser quality prospective study (eg, patients enrolled at different points in their disease or <80% followup)		
		Systematic review[b] of Level II studies		
III	Case control study[g]	Case control study[g]	Study of non consecutive patients; without consistently applied reference ''gold'' standard	Analyses based on limited alternatives and costs; and poor estimates
	Retrospective[f] comparative study[e]		Systematic review[b] of Level III studies	Systematic review[b] of Level III studies
	Systematic review[b] of Level III studies		Case-control study	
			Poor reference standard	
IV	Case series[h]	Case series		Analyses with no sensitivity analyses
V	Expert opinion	Expert opinion	Expert opinion	Expert opinion

[a] A complete assessment of quality of individual studies requires critical appraisal of all aspects of the study design.
[b] A combination of results from two or more prior studies.
[c] Studies provided consistent results.
[d] Study was started before the first patient enrolled.
[e] Patients treated one way (eg, cemented hip arthroplasty) compared with a group of patients treated in another way (eg, uncemented hip arthroplasty) at the same institution.
[f] The study was started after the first patient enrolled.
[g] Patients identified for the study based on their outcome, called "cases" eg, failed total arthroplasty, are compared with patients who did not have outcome, called ''controls'' eg, successful total hip arthroplasty.
[h] Patients treated one way with no comparison group of patients treated in another way.

SUMMARY

VOLUME 32 – Nº 1 – Especial – 2024

Original Article

WRIST AND HAND

Review Article

SHOULDER AND ELBOW

Systematic Review

BONE RECONSTRUCTION AND LENGTHENING

DOI: http://dx.doi.org/10.1590/1413-785220243201e275648

IMPACT OF THE COVID-19 PANDEMIC ON ELECTIVE KNEE SURGERIES IN ATHLETES

IMPACTO DA PANDEMIA DE COVID-19 NAS CIRURGIAS DE JOELHO ELETIVAS EM ATLETAS

Alexandre Pedro Nicolini[1], *José Manoel Dantas Júnior*[1], *Orlando Copetti Fração*[1], *Vinícius Pagliaro Franco*[1], *Alexandre Figueiredo Zobiole*[1], *Paulo Vitor Carrijo*[1]

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ABSTRACT

With the COVID-19 pandemic, elective orthopedic surgeries were interrupted in most healthcare services. This leads to impacts on the quality of life, as well as on the emotional, professional, and financial situation of patient athletes who had their surgical treatment postponed. Objective: To evaluate clinical, emotional, and professional impacts on athletes who had their knee surgery postponed. Methods: This study included 21 patients who were diagnosed with knee injuries and were on a surgical waiting list. Participants answered a questionnaire with socioeconomic questions, activity level (amateur/professional), diagnosis, proposed surgery, and questions about anxiety regarding the postponement and uncertainty of performing the surgery, worsening symptoms, and psychological status in general. Results: The most prevalent diagnosis was anterior cruciate ligament injury (81%). Moreover, 42.9% of patients reported being highly anxious about the date of surgery, with 23.8% being highly anxious about the uncertainty of surgery. There was a direct positive correlation (r = 0.418), indicating a higher level of anxiety in patients who faced greater financial impact. Conclusion: The indefinite postponement of surgeries had a great impact on anxiety levels and surgery uncertainty of patients awaiting surgery. ***Level of Evidence III, Transversal Study.***

Keywords: Knee Injuries. Anxiety. Athletes. COVID-19.

RESUMO

Com a pandemia de COVID-19, as cirurgias ortopédicas eletivas foram interrompidas na maioria dos serviços de saúde. Isso acarretou impacto emocional, profissional, financeiro e na qualidade de vida de atletas que tiveram seu tratamento cirúrgico adiado. Objetivo: Avaliar esse impacto clínico, emocional e profissional em atletas que tiveram suas cirurgias de joelho postergadas. Métodos: Foram selecionados 21 pacientes com diagnóstico de lesão do joelho que estavam aguardando intervenção cirúrgica. Eles responderam um questionário sobre sua situação socioeconômica, nível de atividade (amador/profissional), diagnóstico, cirurgia proposta, ansiedade em relação ao adiamento e incerteza da realização da cirurgia, piora dos sintomas e quadro psicológico de modo geral. Resultados: O diagnóstico mais prevalente foi a lesão do ligamento cruzado anterior (81%). Dos pacientes, 42,9% relataram estar muito ansiosos sobre a data da cirurgia, e 23,8% muito ansiosos quanto à incerteza da cirurgia. Houve correlação positiva direta (r = 0,418) que indicou maior nível de ansiedade nos pacientes conforme o aumento do impacto financeiro. Conclusão: A suspensão indeterminada das cirurgias gerou um grande impacto, com ansiedade e incerteza dos pacientes que estavam aguardando suas cirurgias. ***Nível de Evidência III, Estudo Transversal.***

Descritores: *Traumatismos do Joelho. Ansiedade. Atletas. COVID-19.*

Citation: Nicolini AP, Dantas JM Jr, Fração OC, Franco VP, Zobiole AF, Carrijo PV. Impact of the COVID-19 pandemic on elective knee surgeries in athletes. Acta Ortop Bras. [online]. 2024;32(1)Esp.: Page 1 of 5. Available from URL: http://www.scielo.br/aob.

INTRODUCTION

In March 2020, the World Health Organization (WHO) declared a COVID-19 pandemic due to the rapid spread of the SARS-CoV-2 virus worldwide. The public system and health services were restructured due to the high demand of COVID-19 patients, and as a result, other types of care such as elective surgical procedures were limited and had their appointments postponed.[1,2]

The onset of the COVID-19 pandemic provided unpredictable challenges for the orthopedic community, particularly the subspecialties for knee injuries and sports medicine, as many surgeries were deemed non-essential and, thus, postponed.[3]

In this regard, it should be noted that for several elective orthopedic procedures, longer waiting times may negatively affect postoperative outcome. Moreover, some studies have shown that prolonged waiting times are associated with poorer pre-treatment health status.[4,5]

In addition, in these cases, some aspects of mental health often remain underestimated. Psychosocial distress is known

All authors declare no potential conflict of interest related to this article.

The study was conducted at Universidade Federal de Sao Paulo, Centro de Traumatologia do Esporte.

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to negatively influence postoperative outcomes in patients with musculoskeletal disorders.[1]

Therefore, the main objective of this study is to evaluate the impact of the COVID-19 pandemic on the quality of life, emotional, professional, and financial situation of athlete patients who had their surgical treatment postponed. As a secondary objective, the correlation between the postponement of elective surgery and weight gain, level of physical exercise during the pandemic, agreement with the maintenance of the proposed treatment, and the patient's fear of contracting or transmitting COVID-19 during a possible surgical procedure were evaluated.

MATERIALS AND METHODS

This is an observational, cross-sectional study conducted at the *Centro Especializado em Trauma do Esporte* (CETE/UNIFESP – Specialized Center for Sports Trauma). All participants signed an informed consent form. This study was approved by the Research Ethics Committee, under opinion no. 5.081.763. This study included adult patients diagnosed with knee injuries who required surgical treatment and were on a surgical waiting list.

Selection of participants

A total of 21 patients with knee injuries were selected from the surgical waiting list of the CETE/UNIFESP. After signing the informed consent form, all patients were submitted to a questionnaire with questions about their epidemiological profile: age, sex, sport practiced, level of activity (amateur/professional), diagnosis, and proposed surgery. Moreover, some questions were asked using a Likert scale, regarding anxiety about the postponement and uncertainty of performing the surgery, as well as their psychological status in general.

Inclusion and exclusion criteria

This study included patients aged > 18 years who signed an informed consent form and had surgical indication for knee injury. Patients aged < 18 years who underwent knee surgery in other services during the pandemic or did not sign the informed consent form were excluded.

Statistical analysis

The qualitative characteristics evaluated were described using absolute and relative frequencies for all patients, and the quantitative characteristics were described using means and standard deviations.[6] The anxiety questions were described and compared according to the athletic level. For comparisons, the *Mann-Whitney* test was adopted. Spearman's correlation was calculated to measure the association between the level of anxiety and income impairment. The analyses were performed and tabulated using the IBM SPSS for Windows version 22.0 and the Microsoft-Excel 2010 software programs, respectively, considering a 5% significance level.

Sample estimation

A total of 50 patients were evaluated. After data collection from 25 patients, a sample size estimation was conducted based on the primary objective of the study and the final number of patients was changed to 21 participants.

Primary outcomes

The postponement of elective surgeries in athlete patients who need surgical treatment impacts on the emotional, quality of life, and professional domains, often making it impossible for these patients to perform their activities. Therefore, there was a significant professional, emotional, and economic impact of the COVID-19 pandemic on athlete patients who require surgical treatment for knee injuries.

Secondary outcomes

Athletes were deprived of performing their sports activities daily due to the pandemic evolution and the implementation of social isolation measures. The injured athletes had a greater difficulty to maintain physical shape, weight, and physical activity level. They also presented worsening of knee injuries such as pain and instability.

RESULTS

A total of 21 patients (2 females and 19 males) were included, with the sample being predominantly composed of males (90.5%). The mean sample age was 27 ± 7.9 years old. At least 57.1% of the sample were amateur athletes, and most performed physical activity five or more times per week (57.1%). Table 1 shows that the most prevalent diagnosis was anterior cruciate ligament injury (81%), followed by meniscus injury (9.5%).

Table 1. Description of personal characteristics and practice of sport and diagnosis for all patients.

Variable	Description (n=21)
Sex	
Female	2 (9.5)
Male	19 (90.5)
Age (years)	
Mean ± SD	27 ± 7.9
Athletic level, n (%)	
Amateur	12 (57.1)
Professional	9 (42.9)
Previous frequency of activities, n (%)	
2 week	1 (4.8)
3 week	3 (14.3)
4 week	5 (23.8)
5 or more per week	12 (57.1)
Diagnosis, n (%)	
Anterior cruciate ligament injury	17 (81)
Posterior cruciate ligament injury	1 (4.8)
Meniscus injury	2 (9.5)
Patellofemoral instability	1 (4.8)

Table 2 shows that about 42.9% of the patients reported being highly anxious about the date of surgery. Regarding the uncertainty of surgery, at least 38.1% were moderately anxious and 23.8% were highly anxious. Regarding the pandemic, 42.9% indicated that they were moderately anxious and 23.8% were not anxious. About 76.2% of patients reported that they did not have worsening symptoms during the pandemic. About 23.8% reported being moderately anxious and 23.8% reported being highly anxious about clinical worsening.

Table 2. Description of anxiety and impacts of the injury for all patients.

Variable	Description (n=21)
Level of anxiety about date of surgery, n(%)	
Mildly anxious	5 (23.8)
Moderately anxious	3 (14.3)
Highly anxious	9 (42.9)
Extremely anxious	4 (19)
Level of anxiety about the uncertainty of performing the surgery, n(%)	
Not anxious	2 (9.5)
Mildly anxious	3 (14.3)
Moderately anxious	8 (38.1)
Highly anxious	5 (23.8)
Extremely anxious	3 (14.3)
Pandemic anxiety, n(%)	
Not anxious	5 (23.8)
Mildly anxious	4 (19)
Moderately anxious	9 (42.9)
Highly anxious	1 (4.8)
Extremely anxious	2 (9.5)
Agreement regarding the postponement of surgeries, n(%)	
Total disagreement	2 (9.5)
Mild disagreement	3 (14.3)
Neither agree nor disagree	5 (23.8)
Mild agreement	4 (19)
Total agreement	7 (33.3)
How determined are you in maintaining the proposed treatment? n (%)	
I surely want to undergo surgery	19 (90.5)
I am unsure about surgery	2 (9.5)
How has the postponement impacted you financially? n (%)	
No impact	6 (28.6)
Low impact	2 (9.5)
Medium impact	6 (28.6)
High impact	3 (14.3)
Very high impact	4 (19)
Worry / anxiety about returning to sport, n (%)	
Moderately anxious	4 (19)
Highly anxious	9 (42.9)
Extremely anxious	8 (38.1)
Worry / anxiety about worsening condition (pain / instability), n (%)	
Not anxious	3 (14.3)
Mildly anxious	4 (19)
Moderately anxious	5 (23.8)
Highly anxious	5 (23.8)
Extremely anxious	4 (19)
If surgery is performed, what is your concern about getting COVID 19?, n (%)	
Not anxious	4 (19)
Mildly anxious	8 (38.1)
Moderately anxious	4 (19)
Highly anxious	2 (9.5)
Extremely anxious	3 (14.3)
Worsening symptoms during the pandemic, n (%)	
No	16 (76.2)
Yes	5 (23.8)
What symptoms?, n (%)	
Increased pain (I could not undergo physical therapy)	1 (20)
Pain, swelling, and instability	1 (20)
Pain	1 (20)
Lack of sport practice	1 (20)
Total rupture of the ligament, inflammation of other structures of the knee	1 (20)
Level of physical activity during the postponement period of surgery, n (%)	
Much smaller than usual	11 (52.4)
Smaller than usual	6 (28.6)
Usual	4 (19)
Have you gained weight?, n (%)	
No	14 (66.7)
Yes	7 (33.3)
If so, how much weight?	
Mean ± SD	5.4 ± 3.4 kg

Moreover, at least 52.4% of patients reported a much lower than usual level of physical activity during the pandemic. Only 33.3% reported weight gain, and 38.1% reported being mildly anxious about the risk of contracting COVID-19. At least 28.6% had a moderate impact on income. About 90.5% of the patients intend to maintain the proposed treatment (Table 2).

Table 3 shows that the level of anxiety for all questions addressed to the patients was statistically similar between amateur and professional athletes ($p > 0.05$).

Table 3. Description of the anxiety questions according to the athletic level and the results of the comparative tests.

Variable	Athletic level		p
	Amateur (n=12)	Professional (n=9)	
Level of anxiety about date of surgery			0.422
Mildly anxious	2 (16.7)	3 (33.3)	
Moderately anxious	2 (16.7)	1 (11.1)	
Highly anxious	5 (41.7)	4 (44.4)	
Extremely anxious	3 (25)	1 (11.1)	
Level of anxiety about the uncertainty of performing the surgery			0.808
Not anxious	1 (8.3)	1 (11.1)	
Mildly anxious	2 (16.7)	1 (11.1)	
Moderately anxious	4 (33.3)	4 (44.4)	
Highly anxious	3 (25)	2 (22.2)	
Extremely anxious	2 (16.7)	1 (11.1)	
Pandemic anxiety			0.917
Not anxious	3 (25)	2 (22.2)	
Mildly anxious	3 (25)	1 (11.1)	
Moderately anxious	3 (25)	6 (66.7)	
Highly anxious	1 (8.3)	0 (0)	
Extremely anxious	2 (16.7)	0 (0)	
Worry / anxiety about returning to sport			0.508
Moderately anxious	3 (25)	1 (11.1)	
Highly anxious	5 (41.7)	4 (44.4)	
Extremely anxious	4 (33.3)	4 (44.4)	
Worry / anxiety about worsening condition (pain / instability)			0.754
Not anxious	1 (8.3)	2 (22.2)	
Mildly anxious	3 (25)	1 (11.1)	
Moderately anxious	3 (25)	2 (22.2)	
Highly anxious	2 (16.7)	3 (33.3)	
Extremely anxious	3 (25)	1 (11.1)	
If surgery is performed, what is your concern about catching COVID 19?			0.702
Not anxious	2 (16.7)	2 (22.2)	
Mildly anxious	4 (33.3)	4 (44.4)	
Moderately anxious	3 (25)	1 (11.1)	
Highly anxious	2 (16.7)	0 (0)	
Extremely anxious	1 (8.3)	2 (22.2)	
Level of physical activity during the postponement period of surgery			0.382
Much smaller than usual	7 (58.3)	4 (44.4)	
Smaller than usual	4 (33.3)	2 (22.2)	
Usual	1 (8.3)	3 (33.3)	
Mann-Whitney test			

Table 4 shows that the pandemic anxiety was statistically equal in patients who did and did not have worsening symptoms during the postponement (p = 0.780).

Tabela 4. Description of the pandemic anxiety according to worsening symptoms during postponement and comparative test results.

Pandemic anxiety	Worsening symptoms during the pandemic		p
	No	Yes	
Not anxious	4 (25)	1 (20)	
Mildly anxious	3 (18.8)	1 (20)	0.780
Moderately anxious	7 (43.8)	2 (40)	
Highly anxious	1 (6.3)	0 (0)	
Extremely anxious	1 (6.3)	1 (20)	

Table 5 shows that, despite no statistically significant correlation being found between the pandemic anxiety and the degree of financial impact (p = 0.059), the correlation between the two variables was direct (r = 0.418), indicating a higher level of anxiety in patients who reported higher financial impact.

Table 5. Description of the pandemic anxiety according to the financial impact of patients and the result of the correlation.

Pandemic anxiety	How the postponement impacted you financially					r (p)
	No impact	Low impact	Medium impact	High impact	Very high impact	
Not anxious	3 (50)	0 (0)	1 (16.7)	0 (0)	1 (25)	0.418 (0.059)
Mildly anxious	0 (0)	1 (50)	3 (50)	0 (0)	0 (0)	
Moderately anxious	3 (50)	1 (50)	2 (33.3)	2 (66.7)	1 (25)	
Highly anxious	0 (0)	0 (0)	0 (0)	1 (33.3)	0 (0)	
Extremely anxious	0 (0)	0 (0)	0 (0)	0 (0)	2 (50)	

DISCUSSION

The COVID-19 pandemic has impacted public health, changing the routine of several sectors. This included the surgical sector, which required postponement of elective surgeries, indicating the need for changes in the way these procedures are conducted.[7]
This study found a predominance of males (90.5%) and a mean age of 27 ± 7.9 years. Contrary to these findings, in a study conducted with patients in the waiting list for elective knee replacement during the COVID-19 pandemic, Wilson et al.[8] found a predominance of females (64,9%) and a mean age was 65 years.
Moreover, in this study, it was observed that most participants (42.9%) were highly anxious about the date of surgery and 38.1% were moderately anxious about the uncertainty of performing the surgical procedure. This corroborates the study by Knebel et al.[1] that assessed pre-treatment health status and psychosocial distress after the cancellation of orthopedic surgeries due to COVID-19, finding significant psychosocial distress in some patients due to surgery cancellation.
In the study by Dindar[9] that investigated the levels of anxiety in the health of handball players during the COVID-19 pandemic, about 40.5% of the participants were professional athletes, differently from

<< SUMÁRIO

our study, in which most patients were amateur athletes (57.1%). However, in this study, there was no statistically significant correlation between the pandemic anxiety, corroborating the study by Dindar[9] which also found no significant association between the means of anxiety and COVID-19.

Moreover, in this study, the reported levels of anxiety were statistically similar between amateur and professional athletes, similar to the study by Dindar.[9]

In this study, about 76.2% of patients reported that their symptoms did not worsen during the pandemic. However, in their study, Wilson et al.[8] observed that 23.4% of the patients reported an increase in the dose or frequency of analgesic consumption after being informed about the postponement of surgery and due to worsening symptoms.

Similar to the study by Knebel et al.,[1] about 23.8% of the participants were moderately anxious and 23.8% were highly anxious about clinical worsening. However, 90.5% of the patients intended to maintain the proposed treatment, corroborating the findings of Knebel et al.,[1] in which the trust of most patients in their surgeons and public system was not affected.

In addition, at least 52.4% of patients reported a much lower than usual level of physical activity during the pandemic and only 33.3% reported weight gain. In this context, Sonza et al.[10] pointed out that the practice of physical activity was affected during the pandemic, with an increase in sedentary behavior in both active and inactive individuals. Among active individuals, the time spent exercising was significantly reduced, as well as the motivation to exercise, impacting their performance and health during the pandemic.

In this study, at least 28.6% had a moderate impact on income. Moreover, a direct positive correlation was found between the pandemic anxiety and the degree of financial impact, indicating that anxiety levels in patients increase according to financial impact. This corroborates the statement by Brooks et al.[11] who identified socioeconomic impacts and financial instability as some of the main causes of negative psychological impacts during the pandemic.

Therefore, we can highlight, as strengths of this study, the categorization of patients by intention. Moreover, this research contributes to better understand the consequences of postponement of elective surgeries on athletes, who are an important niche of society, and the impact of surgical postponement on the quality of life and the professional life of patients.

However, this study presents some limitations. Firstly, the small sample size and the fact that it was restricted to patients who were in the same treatment center. Second, the follow-up period was relatively short; therefore, long-term complications, symptoms, or aggravations could not be reported. Third, the application of questionnaires may reflect some difficulties such as the large number of questions, which may cause demotivation and confusion when answering the questionnaires.

CONCLUSION

The results of this research indicate that most patients have a reasonable perspective on surgical delays and intend to maintain the proposed treatment. Most patients did not show worsening symptoms during the pandemic. No significant differences were found in anxiety levels between amateur and professional athletes. Higher levels of anxiety were found in patients who faced greater financial impact.

However, the surgical postponement was impactful, as some patients reported being highly anxious to undergo surgery, which can be characterized as emotional distress resulting from the interruption of elective surgery.

While current societal recommendations provide guidance on safety protocols and patient prioritization, each orthopedic practice should consider its unique situation and use evidence-based medicine when determining surgical timing and patient selection.

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LATERAL EPICONDYLE SLIDING OSTEOTOMY IN KNEE ARTHROPLASTIES WITH VALGUS DEFORMITY

OSTEOTOMIA DE DESLIZAMENTO DO EPICÔNDILO LATERAL NAS ARTROPLASTIAS DE JOELHO COM DEFORMIDADE EM VALGO

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ABSTRACT

Objective: To evaluate the efficacy and safety of sliding osteotomy of the lateral epicondyle in correcting rigid valgus deformity in knee arthroplasty. Methods: A retrospective study of patients undergoing total knee arthroplasty with lateral epicondyle sliding osteotomy between 2006 and 2018. The main outcome was the incidence of complications and adverse events. Secondary outcomes were Visual Analog Scale for Pain, varus stress test, and varus knee thrust during gait. Results: 19 knees (19 participants) were included in the study. The mean follow-up was 4.2 years. There were no cases of infection or reoperation due to instability. Two participants (10.5%) had mild or moderate knee pain (VAS pain = 4.6 ± 1.9). Two arthroplasties (10.5%) had mild varus stress. No participant presented varus thrust. Conclusion: Sliding osteotomy of the lateral epicondyle allows fast and safe ligament balance of knee valgus deformities. ***Level of Evidence I, Case series.***

Keywords: Knee. Osteoarthritis. Arthroplasty. Genu Valgum. Osteotomy.

RESUMO

Avaliar a eficácia e a segurança da osteotomia de deslizamento do epicôndilo lateral na correção da deformidade em valgo rígida na artroplastia de joelho. Métodos: Estudo retrospectivo de pacientes submetidos à artroplastia total do joelho com osteotomia de deslizamento do epicôndilo lateral entre 2006 e 2018. O principal desfecho foi a incidência de complicações e eventos adversos. Os desfechos secundários foram escala visual analógica para dor, teste de estresse em varo e flambagem em varo do joelho durante a marcha. Resultados: Foram incluídos no estudo 19 joelhos (19 participantes). O seguimento médio foi de 4,2 anos. Não houve nenhum caso de infecção ou reoperação devido à instabilidade. Dois participantes (10,5%) apresentaram algum tipo de dor leve ou moderada no joelho (EVA = 4,6 ± 1,9). Duas artroplastias (10,5%) apresentaram estresse em varo leve. Nenhum participante apresentou flambagem em varo. Conclusão: A osteotomia de deslizamento do epicôndilo lateral possibilitou o balanço ligamentar das deformidades em valgo do joelho de forma rápida e segura. ***Nível de Evidência IV, Série de Casos.***

Descritores: *Joelho. Osteoartrite. Artroplastia. Geno Valgo. Osteotomia.*

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INTRODUCTION

Valgus deformity of the knee can be defined as the presence of an angle between the anatomical axes of the femur and tibia equal to or greater than 10 degrees. Valgus accounts for only 10% of total knee arthroplasties (TKAs) and can represent a challenge for the surgeon. Although osteoarthritis is the most common pathology related to this deformity in adults, other inflammatory pathologies such as rheumatoid arthritis, systemic lupus erythematosus, psoriatic arthritis and hemophilic arthropathy are also associated.[1,2] Adequate correction of the deformity in the coronal plane is widely accepted as crucial to the success of a TKA.[3] It is recognized that the correction of a valgus deformity has technical particularities that need to be recognized and addressed by the knee surgeon. It includes the access route, bone cuts and ligament balance.[1,2,4] Several ligament release techniques to correct coronal alignment in valgus knee arthroplasty have been described.[1,5-7] An elegant and efficient alternative is the sliding osteotomy of the lateral epicondyle described by Brilhault et al.[8] This osteotomy releases a bone block that contains the origins of both the lateral collateral ligament (LCL) and the popliteal tendon. The LCL is a crucial factor in knee valgus balance because it influences both extension and flexion space.

All authors declare no potential conflict of interest related to this article.

The study was conducted at Universidade Estadual de Campinas, Hospital de Clinicas.
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Therefore, simply sectioning this structure may not achieve a good balance between the two spaces. Repositioning the epicondyle, on the other hand, allows the surgeon to better equalize these spaces. However, the original description of the surgical technique of this osteotomy is laborious.

This study aims to evaluate the safety and effectiveness of performing a sliding osteotomy of the lateral epicondyle with a simplified technique, without the need to create a square around the epicondyle and without fixing the osteotomy with a screw.

MATERIALS AND METHODS

This study was approved by the local Research Ethics Committee (CAAE 16612719.6.0000.5404) and all selected individuals agreed to participate and signed the Informed Consent Form. This is an observational, retrospective, case series type clinical study. Records of all TKAs performed at a teaching hospital between 2006 and 2018 were retrieved.

The inclusion criteria were participants of both sexes, over 18 years of age, with severe primary or secondary osteoarthritis of the knee and valgus deformity, undergoing TKA with sliding osteotomy of the lateral femoral epicondyle and at least one year of post-operative follow-up.

The exclusion criteria were absence of clinical or radiographic data in the medical records and refusal to participate or sign the Informed Consent Form (ICF).

Indication for sliding osteotomy of the lateral epicondyle

Sliding osteotomy is indicated in fixed valgus deformity when, after release of the ilitibial band and bone cuts, the extension and flexion spaces still have a trapezoidal shape due to excessive lateral tension.[8]

Surgical technique

After delicate dissection and identification of the origins of the popliteal tendon and LCL, an incision is made in the periosteum in the distal region of the lateral condyle. A chisel Straight Lambotte is used to perform the lateral cortical osteotomy containing the insertion of the popliteus and lateral epicondyle originating from the LCL (Figure 1).

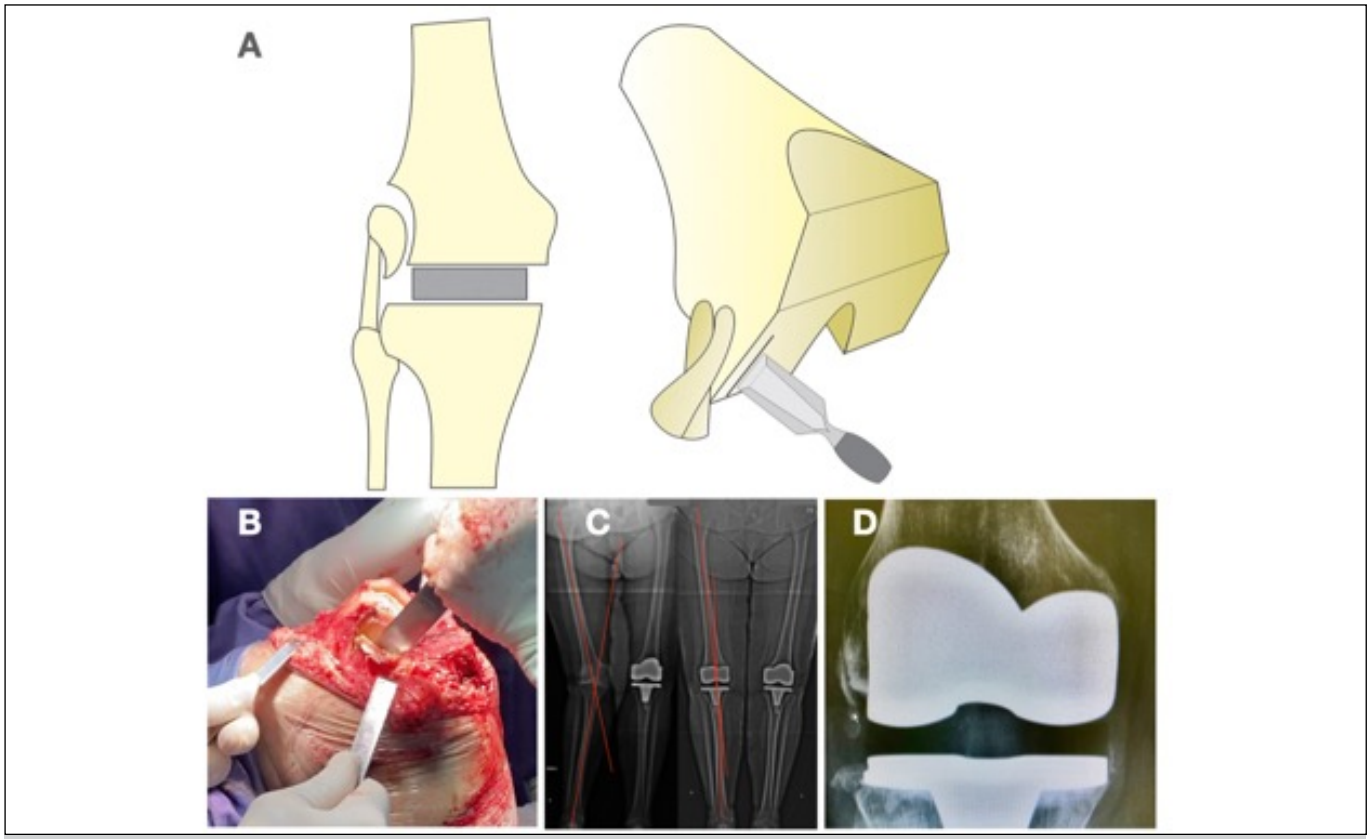

Figure 1. Modified surgical technique for performing sliding osteotomy of the lateral epicondyle in knee arthroplasties with irreducible valgus deformity.

A variation of the technique was used in all cases. There is no need to perform a square osteotomy around the fragment as per the classic description by Brilhault et al.[8] The advantage of this modification is to simplify the surgical procedure and maintain the periosteal insertion of the fragment, preserving its blood supply and ensuring relative stability. For this reason, at the end of the procedure, it is not necessary to fix the osteotomy with a screw. The fragment will accommodate itself in the best position according to the movement of the knee post-operatively. As part of the periosteum remains intact, the fragment still maintains some tension on the LCL.

In the present study, the implant used in all cases was the cemented primary prosthesis Modular III (Víncula, Rio Claro – Brazil). The posterior cruciate ligament was sacrificed in all cases. All prostheses were cemented and the patellar component was used in all cases. No drain was used in any case.

Clinical assessment

Information on the range of motion (ROM), visual analogue scale (VAS), presence of varus thrust during gait, varus stress test of the knee in full extension and at 30 degrees of flexion. The VAS scale was stratified into mild pain (1 to 3), moderate pain (4 to 6),

severe pain (7 to 9) and unbearable pain (10). The varus stress test was classified as mild, moderate or severe subjectively by the examiner. The main outcome of this study was the incidence of adverse effects, mainly side pain, instability and revision surgery.

Radiographic assessment

Radiographs taken pre-operatively and during the post-operative follow-up were consulted. Krackow's classification of knee valgus was used.[9,10] The anatomical femoraltibial (FT) angle was measured on standard monopodal radiographs in the frontal plane.

Statistical analysis

There was no prior calculation of the sample size as it was a convenience sample. Qualitative variables appear as absolute and relative frequencies. Quantitative variables appear as mean, standard deviation (SD) and range.

The distribution of each continuous variable was assessed by the Kolmogorov-Smirnov test. Mean results were compared with Student's t-tests for independent or paired samples or the Mann-Whitney test for independent samples and the Wilcoxon test for paired samples when these assumptions were rejected. Pearson's chi-squared test or Fisher's exact test were used for comparisons of qualitative variables. All tests were two-tailed. The significance level was set at 5% ($p < 0.05$). Analyses were carried out using SPSS version 22.0 (Armonk, NY: IBM Corp.).

RESULTS

Between 2006 and 2018, 52 patients who underwent total knee arthroplasty for valgus deformity were identified, 19 of whom underwent sliding osteotomy of the lateral epicondyle.

Table 1 presents patient demographic data. There was a predominance of women, the right side was operated on more frequently and the prevalence of overweight patients was high in this sample. The minimum follow-up time was 1 year and the maximum was 13 years.

Table 1. Participant demographic data.

	N = 19
Age	65.5 years ± 13.1 SD (32 to 81 years)
Male	3 (15.8%)
Female	16 (84.2%)
Right knee	12 (63.2%)
Left knee	7 (36.8%)
Weight	77.8 kg ± 13.9 SD (62 to 110 kg)
Height	165 cm ± 10 SD (149 to 188 cm)
BMI	28.8 ± 5.2 SD (23.1 to 43)
Follow-up time	4.2 years ± 3.0 SD (1 to 13 years)

BMI: body mass index; SD: standard deviation.

Thirteen knees (68.4%) were classified as Krackow type 1. Six knees (31.6%) were classified as Krackow type 2. No knees were classified as Krackow type 3.

The preoperative FT angle ranged from 13 to 40 degrees of valgus deformity. The mean preoperative FT angle was 22.3 degrees ± 6.0 SD. The postoperative FT angle ranged from 1 to 13 degrees. The mean postoperative FT angle was 7.3 degrees ± 3.6 SD ($p < 0.05$; 95% CI 11.5-18.6).

Only two knees (10.5%) failed to reach full extension. One of them had a 10- degree deficit and the other a 30-degree deficit.

No participant presented varus knee thrust in the clinical gait examination.

There was no positive varus stress test in extension, but two knees (10.5%) showed mild positive varus stress at 30 degrees of flexion. Both cases were classified as Krackow type 1 preoperatively. These two participants had moderate pain (VAS = 6) and one of them had an extension limitation of 30 degrees.

Five participants (26.3%) reported some knee pain. The VAS scale for these patients ranged from 2 to 6 (4.6 ± 1.9 SD), on a 0-10 scale. Two participants had mild pain and three participants had moderate pain.

DISCUSSION

The main finding of this study was the low incidence of adverse events related to sliding osteotomy of the lateral epicondyle, even without screw fixation. Major problems such as reoperations, early loosening, deformities and varus thrust were not observed.

Since their pioneering work in 1979, Insall, Scott and Ranawat[11] have described the technique of soft tissue ligament balancing through serial release of the iliotibial band, lateral aspect of the capsule, LCL and popliteus tendon. As it is a laborious technique, many variations have been described, including sequential Whiteside releases, Keblish lateral approach, tibial tube osteotomy, sliding osteotomy of the lateral condyle and pie crusting intra-articular releases.[1,8,12-15]

There are few reports with case series of lateral epicondyle sliding osteotomies to correct knee valgus deformity. The first description was by Brilhault et al. in 2002,[8] who reported a series of 13 patients, always fixed with screws. The authors report that they achieved satisfactory stability and alignment. Mullaji and Shetty[16] presented a computerized navigation technique to improve positioning accuracy, but did not describe clinical results.

Recently, three new articles with case series were published on the subject. Scior et al.[17] described a cohort of patients operated on between June 2007 and May 2014. Ninety-eight patients were treated with 98 sliding osteotomies, all fixed with screws. All knees achieved satisfactory alignment. However, seven revisions (7.1%) were reported, three of which were procedure-related. In two there was dehiscence of the lateral joint capsule, while in one there was loosening of the epicondyle.

In the study by Li et al.[18] 25 knees were included between 2011 and 2017, with a mean follow-up of 3.3 years. Adequate stability and alignment were achieved and there was no revision surgery. Furthermore, all osteotomies were also fixed with screws.

In the third study, Raut, Matar and Singh[19] described a retrospective case series with 25 knees and a mean follow-up of 5 years. There was an improvement in the clinical scale of the Oxford Knee Score and there were no cases of revision. In this study, fixation of the lateral epicondyle was not performed, corroborating the findings of our study.

This study has some limitations. Firstly, it is a retrospective study, with the potential for bias inherent in this type of design. As this is an uncommon surgery and complications are rare, it would be unfeasible to conduct a prospective study in a single center. Secondly, we had a small number of participants. Arthroplasties in severe valgus knees, which require advanced techniques to achieve ligament balance, end up being uncommon. Thirdly, we did not assess bony union at the osteotomy site. We believe that union is always achieved, either by bone or soft-tissue consolidation, as there is no postoperative lateral instability. Finally, the lack of a control group prevents conclusions about the effectiveness of the technique compared to other ways of achieving ligament balance.

A new study, already ethically approved, will soon be carried out with gait laboratory analysis to compare patients who underwent TKA with valgus deformity, with and without lateral epicondyle osteotomy.

CONCLUSION

The results obtained in this sample are compatible with those described in the literature and corroborate the hypothesis that lateral epicondyle sliding osteotomy is a safe and effective procedure for ligament balance of knee prostheses with valgus deformity. They also support the hypothesis that screw fixation is unnecessary.

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CORRELATION BETWEEN THE SEVERITY AND BLOOD ALCOHOL LEVEL OF TRAFFIC ACCIDENTS VICTIMS

CORRELAÇÃO ENTRE GRAVIDADE E ALCOOLEMIA DE VÍTIMAS DE ACIDENTES DE TRÂNSITO

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ABSTRACT

Objective: To evaluate the correlation between blood alcohol levels and the severity of injuries assessed by the Injury Severity Score (ISS) in patients who were victims of traffic accidents admitted to the Hospital das Clínicas of the Faculty of Medicine of the University of São Paulo (HCFMUSP). Methods: Cross-sectional study carried out between July 2018 and June 2019, at the Central Emergency Room of the Hospital das Clínicas of the Faculty of Medicine of the University of São Paulo (PSC-HCFMUSP). A total of 172 hospitalized patients victims of traffic accidents were included in this study. Blood samples were analyzed by the FMUSP Toxicology Laboratory. Results: 36 patients (20.9%) had positive BAC (≥ 0.2 g/L) with a mean of 1.21 g/L. Overall, patients had a mean age of 37.2 years old, and 136 (79.1%) were men. The ISS of the total casuistry was 15.6; regarding the external cause, the motorcycle was ranked first with 100 cases (58.1%), and drivers were the majority with 57.4% of the sample. Conclusion: There was no correlation between the severity of the injuries and the blood alcohol levels of traffic accident victims admitted to a reference hospital. ***Level of Evidence II, Cross-Sectional Study.***

Keywords: Ethanol. Wounds and Injuries. Accidents, Traffic. Injury Severity Score. Legislation. Blood Alcohol Content.

RESUMO

Objetivo: Avaliar a correlação entre a alcoolemia e a gravidade das lesões avaliadas pelo Índice de Gravidade da Lesão (Injury Severity Score – ISS) em vítimas de acidentes de trânsito internadas no Hospital das Clínicas da Faculdade de Medicina da Universidade de São Paulo (HC-FMUSP). Método: Estudo transversal realizado entre julho de 2018 e junho de 2019, no Pronto Socorro Central do HC-FMUSP. Foram incluídas 172 vítimas de acidentes de trânsito. Amostras de sangue foram analisadas pelo Laboratório de Toxicologia da FMUSP. Resultados: 36 pacientes (20,9%) apresentaram alcoolemia positiva (≥ 0,2 g/L), com valor médio de 1,21 g/L. No geral, os pacientes tinham uma idade média de 37,2 anos, e 136 (79,1%) eram homens. O ISS da casuística total foi 15,6; quanto à causa externa, a motocicleta ficou em primeiro lugar com 100 casos (58,1%); e os condutores foram prevalentes entre as vítimas (57,4%). Conclusão: Não houve correlação entre a gravidade das lesões e a alcoolemia das vítimas de acidente de trânsito internadas em um hospital de referência. ***Nível de Evidência II, Estudo de Corte Transversal.***

Descritores: *Etanol. Ferimentos e Lesões. Acidentes de Trânsito. Escala de Gravidade do Ferimento. Legislação. Concentração Alcoólica no Sangue.*

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INTRODUCTION

Traffic accidents are a global public health problem and closely associated with the consumption of alcohol. [1] In Brazil, according to Information Technology at the Service of SUS (DATASUS), there were 33,716 deaths caused by traffic accidents in 2020.[2]

In 2008, the government enacted Law No. 11,705[3] called "*Lei Seca*" (Prohibition), establishing zero blood alcohol for drivers. This measure was attributed, among other factors, to the reduction in morbidity and mortality in the state and city of São Paulo related to traffic accidents.[4]

Alcohol consumption causes decreased visual ability, increased reaction time, impaired concentration and performance of tasks that require divided attention, in addition to an increased risk of collision.[5] However, there are controversies about the influence of alcohol on the severity of injuries caused by traffic accidents.[6,7]

All authors declare no potential conflict of interest related to this article.

The study was conducted at Universidade de Sao Paulo, Faculdade de Medicina, Hospital das Clinicas HC-FMUSP.
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Tulloh and Collopy[8] report a positive association between alcohol intoxication, impact velocity, *Injury Severity Score* (ISS) and a higher risk of death. Other researchers claim that risky behavior (such as speeding and not wearing a seat belt or helmet) is not associated with the presence of alcohol in the blood.[9]

There are many studies on the mortality of traffic accidents, while morbidity data are rarer, although important, due to the associated human and socioeconomic costs.

MATERIALS AND METHODS

This is a cross-sectional study carried out between July 2018 and June 2019, at the Central Emergency Room of the Hospital das Clínicas of the Medical School of the University of São Paulo (PSC-HCFMUSP) in inpatients victim of traffic accidents. This study is part of the project entitled "Factors related to traffic accidents with victims treated at the Central Emergency Room and who were admitted to the Hospital das Clínicas of FMUSP", approved by CAPPesq HCFMUSP (No. 2,071,227).

A total of 172 patients were included, victims of traffic accidents who were admitted to the Central Emergency Room and were hospitalized at the Hospital das Clínicas of FMUSP. Blood samples from the victims were collected in *Vacutainer* ® tubes containing sodium fluoride and EDTA. The asepsis of the collection site was performed with non-alcoholic solution in order to avoid contamination. Samples were sent to the Toxicology Laboratory of the Department of Legal Medicine, Bioethics, Occupational Medicine and Physical Medicine and Rehabilitation of FMUSP for toxicological analysis by gas chromatography-FID after extraction via *headspace*, a methodology already established in the laboratory. For this study, the value adopted for positive blood alcohol levels was ≥ 0.2 g/L based on Law 11,705/2008.[3]

After the initial care and stabilization of the victim, the medical team and/or trained nurses applied the ISS through a tool built and adapted from CAIS 85–F and CAIS 85-P, maps that summarize the AIS manual and that give greater agility in the calculation of the ISS[10] already validated and implemented in the institution. In doubtful cases, consensus was established by team discussion. After referral to inpatient units (wards), conscious patients were approached to sign the Informed Consent Form, and a questionnaire was applied to obtain sociodemographic and accident-related information. For patients who were in a coma, intubated for more than 10 days or who could not answer the questions, the interview and signing of the ICF was done by a family member or legal guardian.

For categorical variables, the results were presented as mean, standard deviation and frequencies (percentages). In the continuous variables, distribution analyses were performed. The relationship between the different ISS groups and the categorical variables was performed using Pearson's chi-square test. The F–ANOVA test was used to identify deterministic relationships between a categorical variable and a continuous variable. The analyses were performed using the *R Core Team 2021 software*, and the significance level was established as $p < 0.05$.

RESULTS

During the collection period, 909 patients with traumatic injuries were treated at PSC–HCFMUSP. Of these, 172 patients were eligible for inclusion in the study.

The age of the patients ranged from 18 to 87 years old (37.2 ± 14.7) and 136 of them (79.1%) were men. The age of males (34.68 ± 10.7 years) was higher than that of females (20.5 ± 2.1 years) for the alcohol-positive group. The age of the female victims varied between the negative 47.38 ± 20.88 years versus positive 20.5 ± 2.12 years groups.

Other sociodemographic information and the relationship between the categorical variables of the different groups can be seen in Table 1.

Table 1. Sociodemographic characteristics of the patients included in the study separated by Positive and Negative Group.

Category	ALL n (%)	POSITIVE n (%)	NEGATIVE n (%)	*p* = value	X
Gender					
Male	136 (79.1%)	32 (23.5%)	104 (76.5%)	0.0298	4.7203
Female	36 (20.9%)	2 (5.6%)	34 (94.4%)		
All	172	36 (20.9%)	138 (80.2%)		
Age range					
18 to 29	60 (34.9%)	14 (23.3)	46 (76.6%)	0.233	5.5781
30 to 39	52 (30.2%)	11 (21.2%)	41 (78.8%)		
40 to 49	32 (18.6%)	5 (15.6%)	27 (84,4%)		
50 to 59	13 (7.6%)	4 (30.8%)	9 (69.2%)		
60	15 (8.7%)	0 (0%)	15 (100%)		
Education level					
Illiterate	0 (0%)	0 (0%)	0 (0%)	0.6273	1.7436
Incomplete elementary school	37 (21.5%)	7 (18.9%)	30 (81.1%)		
Complete elementary school	14 (8.1%)	3 (21.4%)	11 (78.6%)		
Incomplete High school	28 (15.7%)	7 (25%)	21 (75.0%)		
Complete high school	61 (35.5%)	16 (26.2%)	45 (73.8%)		
Higher Education	29 (16.9%)	1 (3,4%)	28 (96.6%)		
N/C	3 (1.7%)	0 (0%)	3 (1.7%)		
Skin color/race					
White	78 (45.3%)	13 (16.7%)	65 (83.3%)	0.1415	6.8954
Mixed	63 (36.6%)	14 (22.2%)	49 (77.8%)		
Black	25 (14.5%)	6 (24%)	19 (76%)		
Asian	3 (1.7%)	0 (0%)	3 (100%)		
N/C	3 (1.7%)	1 (33%)	2 (67%)		
Driver's License					
Yes	107 (62.2%)	21 (19.6%)	86 (80.4%)	0.9507	0.0038
No	61 (35.5%)	13 (21.3%)	48 (78.7%)		
N/C	4 (2.3%)	2 (50%)	2 (50%)		

N: number of patients; %: percentage of patients; NC: not included

In the total sample, 36 (20.9%) victims had positive blood alcohol (≥ 0.2 g/L), with a mean of 1.21 ± 0.75 g/L. The alcohol concentration in the positive Alcohol Group ranged from 0.3 to 2.8 g/L. Twenty-five (69.4%) patients had alcohol ≥ 0.6 g/L and presented ISS 16.48. Male victims had a mean blood alcohol level of 1.26 ± 0.75 g/L *versus* 0.39 ± 0.11 g/L for females.

Drivers, with 19 cases (20.2%), were prevalent among the alcohol positive group, in addition, motorcycle, with 100 cases (58.1%), was the vehicle most involved with ISS = 15.52 ± 11.23, a lower value compared to other vehicles 17.46 ± 12.25. There was no correlation between the variables type of victim, vehicle, type of accident, day of the week and type of care, and the degree of alcohol level. (Table 2)

Table 2. Characterization of the types of accidents suffered by the patients included in the study, separated into the Positive and Negative Blood Alcohol Content groups

Category	ALL n (%)	POSITIVE n (%)	NEGATIVE n (%)	*p* = value	X
Victim					
Driver	94 (54.7%)	19 (20.2%)	75 (79.8%)	0.7239	1.3222
Passenger	23 (13.4%)	6 (26.1%)	17 (73.9%)		
Pedestrian	46 (26.7%)	7 (15.2%)	39 (84.8%)		
Cyclist	8 (4.7%)	2 (25%)	6 (75%)		
N/C	1 (0.6%)	0 (0%)	1 (100%)		
Vehicle					
Motorcycle	100 (58.1%)	19 (19%)	81 (81%)	0.8033	1.6305
Automobile	32 (18.6%)	6 (18.8%)	26 (81.2%)		
Bicycle	9 (5.2%)	3 (33.3%)	6 (66.7%)		
Bus	11 (6.4%)	3 (27.3%)	8 (72.7%)		
Truck	13 (7.6%)	2 (15.4%)	11 (84.6%)		
N/C	7 (4.1%)	1 (14%)	6 (86%)		
Type of Accident					
Frontal collision	50 (29.1%)	9 (18%)	41 (82%)	0.2459	7.8952
Lateral collision	30 (17.4%)	10 (33.3%)	20 (66.7%)		
Rollover	5 (2.9%)	1 (20%)	4 (80%)		
Fall	12 (7%)	2 (16.7%)	10 (83.3%)		
Runover	50 (29.1%)	7 (14%)	43 (86%)		
Rear collision	7 (4.1%)	0 (0%)	7 (100%)		
Multiple	5 (2.9%)	0 (0%)	5 (100%)		
N/C	18 (10.5%)	5 (28%)	13 (72%)		
Day of the Week					
Monday	32 (18.6%)	8 (25.0%)	24 (75.0%)	0.1091	10.3909
Tuesday	18 (10.5%)	2 (11.1%)	16 (88.9%)		
Wednesday	26 (15.1%)	4 (15.4%)	22 (84.6%)		
Thursday	26 (15.1%)	2 (7.7%)	24 (92.3%)		
Friday	23 (13.4%)	4 (17.4%)	19 (82.6%)		
Saturday	25 (14.5%)	5 (20%)	20 (80%)		
Sunday	22 (12.8%)	9 (40.9%)	13 (59.1%)		
Pre-hospital Care					
Yes	160 (93%)	30 (18.8%)	130 (81.3%)	1.00	0.00
No	6 (3.5%)	1 (16.7%)	5 (83.3%)		
N/C	6 (3.5%)	3 (50%)	3 (50%)		
Type of Service					
SAMU	58 (33.7%)	10 (17.2%)	48 (82.8%)	0.9488	0.3578
Fire Department	31 (18%)	5 (16.1%)	26 (83.9%)		
Águia	61 (35.5%)	11 (18%)	50 (82%)		
Other	8 (4.7%)	2 (25%)	6 (75%)		

N: number of patients; %: percentage of patients; NC: not included; X^2: chi-square; *P:* degree of significance.
* *P*-value < 0.05

The ISS of the total sample was 15.6 ± 11.06 (p = 0.65), with no significant difference in male patients with negative and positive blood alcohol levels (p = 0.62). Women showed greater variation between the negative and positive groups (p = 0.08). The distribution of the number of patients according to ISS in the two groups separated by sex can be seen in Table 3.

There was no correlation between the severity index (ISS) and alcohol dosage (Figure 1).

Table 3. Comparison of victims' ISS value and blood alcohol concentration

	Men			Women		
	ALL n (%)	POSITIVE n (%)	NEGATIVE n (%)	ALL n (%)	POSITIVE n (%)	NEGATIVE n (%)
Mean ISS	15.11 (± 10.24)	16 (± 11.98)	14.84 (± 9.69)	17.33 (± 13.76)	22.5 (± 2.12)	17.02 (± 14.11)
Light ISS (0 -15 points)	80 (58.8%)	18 (22.5%)	62 (77.5%)	19 (52.8%)	0 (0%)	19 (100%)
Moderate ISS (16 -24 points)	33 (24.3%)	7 (21.2%)	26 (78.8%)	10 (27.8%)	2 (20.0%)	8 (80%)
Severe ISS (25 points)	23 (16.9%)	7 (30.4%)	16 (69.6%)	7 (19.4%)	0 (0%)	7 (100%)
Total	136	32 (23.5%)	104 (76.5%)	36	2 (5.6%)	34 (94.4%)

Caption: N: number of patients; %: percentage of patients; ± = standard deviation; ISS: *Injury Severity Score*

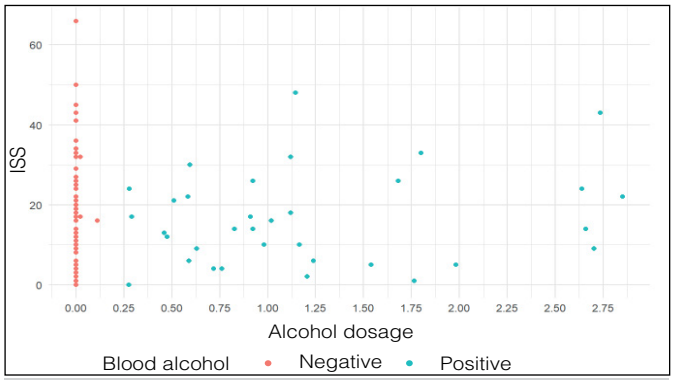

Figure 1. Relationship between Severity Index (ISS) and alcohol dosage of all patients enrolled in the study (p= 0.0803

There was no correlation between ISS and blood alcohol in patients with alcoholic dosage > 0.2 g/L (Figure 2)
In the qualitative analysis, in relation to alcohol consumption, in response to question 1 "frequency of alcohol consumption", 115 (66.8%) participants consume alcohol with varying frequencies, data seen in Figure 3. The Positive Alcohol Group consumes alcohol more frequently than the Negative Alcohol Group.

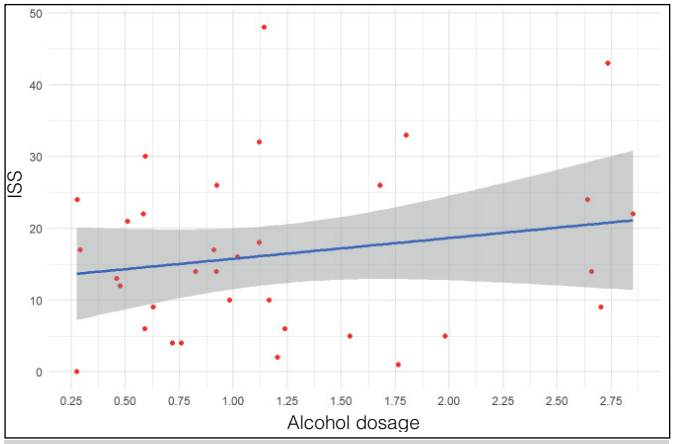

Figure 2. Relationship between Severity Index (ISS) and Alcohol Dosage of patients who had positive alcohol levels (≥ 0.2 g/L) (p= 0.1901)

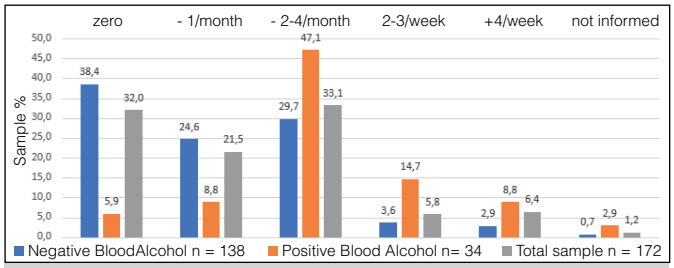

Figure 3. Percentage of patients in the Positive Alcohol, Negative Alcohol and Total Sample Groups distributed according to the frequency of alcohol intake (X^2 = 34.2368, p = 0.000).

In the answer to question 2 "how many alcoholic drinks do you consume in a normal day?" The Positive Alcohol Group ingests more doses per day than the Negative Alcohol Group (Figure 4).
In answer to question 3 "how many times do you ingest four doses (women) or five doses (men) on a single occasion". The Positive Alcohol Group showed a higher percentage of participants who drink abusively at least once a week or daily (Figure 5).

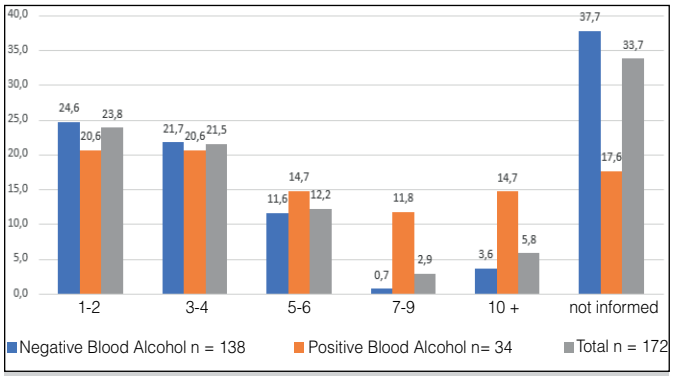

Figure 4. Percentages of patients in the Negative and Positive Alcohol and Total Sample Groups distributed according to the number of daily doses of alcoholic beverage ingested (X^2 = 13.6692 p= 0.0084).

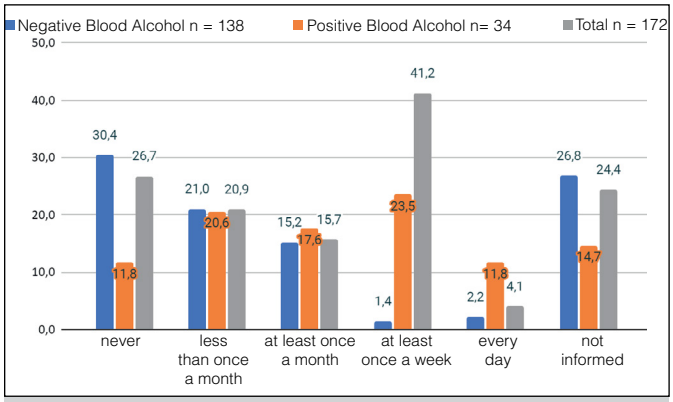

Figure 5. Percentages of patients in the Positive and Negative Alcohol and Total Sample Groups distributed according to the temporal frequency that drink four (women) or five (men) doses on a single occasion (X^2 = 19.7918, P = 0.0005).

In the answer to question 4 "did you drink alcohol in the six hours before the accident". Most of the Positive Alcoholic Group had ingested some type of drink six hours before the accident, diverging from the Negative Alcoholic Group (Figure 6).
Table 4 shows the correlation between the different qualitative variables and the ISS level of all patients grouped by Total Group (n= 172), Positive Alcohol Group (n= 34) and Negative Alcohol Group (n= 138). The F test evaluated which variables are determinant in the severity of the accident.

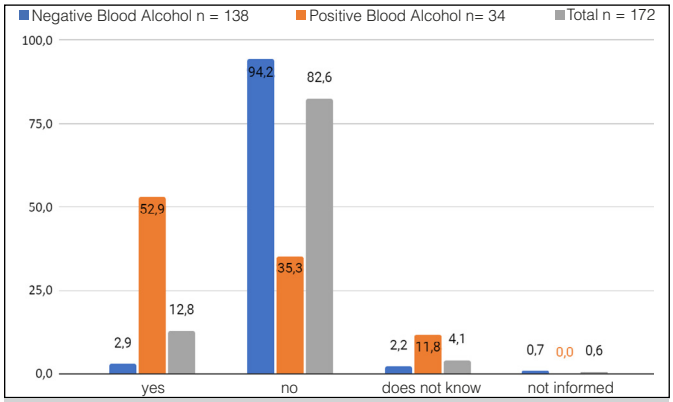

Figure 6. Percentages of participants in the Positive, Negative and Total Alcohol Group who drank or did not drink alcohol six hours before the accident (X^2: 70.7286 p:0.000).

Table 4. Correlation between the different qualitative variables of the sample and the ISS value, separated by all patients in the sample, patients with positive blood alcohol and patients with negative blood alcohol.

	F-value			Pr(> F)		
	All patients included	Patients with positive blood alcohol	Patients with negative blood alcohol	All patients included	Patients with positive blood alcohol	Patients with negative blood alcohol
Day of the Week	0.453	0.35	0.31	0.84	0.89	0.92
Age group	0.324	1.07	0.68	0.86	0.37	0.60
Gender	1.142	0.57	1.02	0.28	0.45	0.31
Skin color	0.288	2.80	0.31	0.83	0.07	0.81
Education	1.824	1.48	1.12	0.11	0.23	0.34
Driver's License	0.636	4.66	0.40	0.53	0.03	0.66
Victim	0.924	1.40	0.33	0.43	0.26	0.79
Vehicle	1.253	1.01	0.63	0.28	0.41	0.67
Type of Accident	1.576	0.29	2.30	0.14	0.91	0.03
Pre-hospital Care	5.841	0.76	6.90	0.00	0.47	0.00
Type of Service	3.109	0.86	3.83	0.01	0.50	0.00
Question 1	1.546	0.88	1.07	0.19	0.48	0.37
Question 2	1.653	1.07	2.61	0.15	0.39	0.02
Question 3	1.747	1.49	0.86	0.12	0.23	0.50
Question 4	4.600	10.10	0.05	0.01	0.00	0.94

Df: degree of freedom; Sum Sq: sum of squares; Mean Sq: mean squares; F value: F statistic; Pr(> F)= p-value for F statistic.

A significant correlation was observed in the Driver's License variable for the Positive Group for alcohol, where patients who did not have a driver's license had more severe lesions than those who did (mean ISS of 21.61 versus 13.14, respectively) (p= 0.03).

The variable Type of Accident had its significance level evidenced in patients in the Negative Group for alcohol (p= 0.03). The victims of lateral collision presented ISS= 17.4, a higher value compared to the other mechanisms (frontal collision 14.9; runover: 16.04; fall: 15.8; rollover: 13.5; multiple: 11.2; rear collision: 4.71).

Prehospital care was statistically relevant in the Total Group and Negative Alcohol Group (p= 0.00). In the Total Group of patients, 6 (3.5%) individuals were unable to answer if they had pre-hospital care, with ISS= 30.33, higher than the other victims (Yes= 15.36; No= 6.66). In the Negative Alcoholic Group, 3 patients were unable to report whether they had treatment, with ISS value = 29.33, higher than the others (Yes= 15.37; No= 7.2).

The variable Type of Care was also relevant in the Total Group and Negative Alcohol Group (p= 0.01 and p= 0.00, respectively). In the Total Group, 13 patients were unable to answer the question with ISS= 24.38, higher than the other patients (Águia= 16.90; Firefighters= 15.67; SAMU= 13.31; Others= 7.62).

Question 2 was significant in the Negative Alcohol Group (p= 0.02). A single patient reported drinking 7-9 doses, with the highest ISS value = 32; 34 patients reported consuming 1-2 doses (ISS= 17.26), 52 patients reported no consumption (ISS= 16.96), 5 reported consuming ≥ 10 doses (ISS= 16.6); 30 reported consuming 3-4 doses (ISS= 12.7); 16 patients consumed 5-6 doses (ISS= 9.8).

Question 4 showed a significant correlation in two groups, Total patients (p= 0.01) and Positive Alcohol (p= 0.00). In the Total Group, 22 patients reported "yes" and had ISS= 14.27; 142 answered "no" with ISS= 15.23; 7 answered "do not know" with ISS= 27.71; 1 patient "did not answer" with ISS= 8.0. In the Positive Group, 18 patients reported "yes" with ISS= 13.66; 12 answered "no" ISS= 13.83; 4 did not know how to answer ("do not know") ISS= 36.25.

The variables mentioned, according to their groups, had a statistically significant relationship with the severity of the accident, measured by the ISS, at 95% confidence. For the other independent variables of the groups analyzed, it was possible to state that there are no statistically significant relationships with the level of severity of the injuries.

DISCUSSION

The association of alcohol with driving is one of the main factors related to traffic accidents with victims.[1] According to the American College of Surgeons,[11] preventable injuries are the main causes of chronic disabilities in Americans.[11] In Brazil, traumas are treated mainly in hospitals of the Unified Health System (SUS), and contribute significantly to the overcrowding of services, requiring a significant part of budgetary resources.[12]

This study evaluated the relationship between blood alcohol levels of victims of traffic accidents and the severity of injuries measured by the ISS. Previous studies show a relationship between the presence of alcohol and the risk of more serious injuries[13], however, the blood alcohol dosage in these studies was performed post-mortem, and may not reflect the alcohol concentration at the time of the accident.[9] It is also noted that most studies evaluated mortality, without reference to morbidity.[5-7,9,14,15]

Blood alcohol dosage, when performed at the beginning of care, can help in the conduct of treatment (level of consciousness and hypotension).[11,16] Blood alcohol can increase vasodilation and impair volume resuscitation, in addition to greater predisposition to other complications.[17]

Studies have investigated the correlation between acute alcohol intoxication and the morbidity and mortality of traumatic injuries, however, there is no agreement in the literature and the results range from lower to higher chance of mortality and non-interference.[6-8,14,15,17,18] Stübig et al.[6] report higher mortality of patients with positive blood alcohol levels (4.6% vs. 2.2%). Ponce et al.[13] and Andreuccetti et al.[4] evaluated fatal victims of traffic accidents in the city of São Paulo and reported that more than 40% had positive blood alcohol levels. The evidence was also reported by other researchers.[7] Ahmed and Greenberg[15] maintain that the presence of alcohol does not alter length of stay and mortality rate.[15] Stübig et al.[6] also states that the higher the blood alcohol level, the more severe the lesions. This relationship was not validated

in our sample, as alcohol was not an aggravating factor for the injuries suffered by patients.

The predominance of young male adults has been recorded in many studies involving accidents of a traumatic nature[15,18,19,20], which was also validated in this study. According to Chen et al.[20] age is an important factor in the involvement in traffic accidents.[20] The high-risk trend is concentrated in the age group from 18 to 30 years old.[20] However, our study does not validate this association, as we did not identify statistical significance between the severity of the injuries and the different age groups evaluated, whether or not associated with alcohol.

As in our sample, the lower involvement of women in traffic accidents is frequently reported.[21] The lower proportion of women in accidents and with alcohol present is associated with differences in the consumption habits and behavior of Brazilian women.[13] Women are more cautious and less aggressive than men in terms of driving attitude. However, when involved in accidents or under the influence of alcohol, they present more serious injuries.[20] Although we observed a difference in the severity of women in the different groups, this value was not significant.

The economic difficulty and the emergence of several delivery apps in the country contributed to the growth in the motorcycle fleet.[12] In other studies, motorcyclists had a higher chance of injury and death compared to drivers of other vehicles.[15] In general, they have a tendency to make impulsive decisions and have greater risk behavior, which is aggravated when drunk.[5,6,15]

Although the motorcycle was the main vehicle involved in accidents in this sample, we did not identify statistical significance compared to other vehicles, presence of alcohol and severity of injuries, a finding which differs from other reports in the literature.

In this study, the lack of driver's license in the alcohol-positive population generated more serious injuries than in those who had a license. A lack of a driver's license may indicate that the driver is unskilled or unmotivated to drive safely.[9]

The severity of the injuries in our study was not linked to the presence of alcohol, but to other factors, such as the collision mechanisms. According to data from the Surveillance of Chronic Diseases by Telephone Survey (VIGITEL – 2013), [22] the habit of drinking is reported by one tenth of the Brazilian population, also being highly present in this sample.

In general, we did not find a significant difference in the correlation between the level of severity of the lesion and the alcohol levels of the patients. This finding corroborates some studies[15] but is conflicting with others,[6] with no consensus among researchers. That said, alcohol alone cannot be considered a predictor of more serious injuries.

The small sample size was one of the limitations found in this study. The loss due to insufficient data (in the medical records) and the exclusion of death cases lead to the decreased sample. In the future, similar analyses will be required, with larger samples. Other studies are necessary to evaluate the relationship between the severity of the injury associated with alcohol and other variables: time of accidents, weather conditions, use of protective equipment, purpose of the trip, fatigue, distraction and sleep deprivation. Continuous evaluation of the evidence is necessary to assess the effectiveness of the programs instituted.

This investigation was limited to the severe trauma population in a single hospital; thus, our inferences may not be generalizable to other populations or institutions, but we believe that the results presented here can serve as a starting point and support for the implementation of evidence-based public prevention policies.

CONCLUSION

About 21% of the victims included in the sample had positive blood alcohol levels. Men with a mean age of 37.2 ± 14.75 years, motorcycle drivers and people with higher blood alcohol concentrations appeared in higher prevalence.

There was no correlation between the severity of injuries and blood alcohol levels of traffic accident victims admitted to a referral hospital. Taking into account our results, alcohol alone cannot be considered a predictor of more serious injuries.

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FUNCTIONAL CAPACITY IN PATIENTS WITH KNEE OSTEOARTHRITIS: CROSS-SECTIONAL STUDY

CAPACIDADE FUNCIONAL EM PACIENTES COM OSTEOARTRITE DE JOELHO: ESTUDO TRANSVERSAL

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ABSTRACT

Knee osteoarthritis (KOA) is a disabling inflammatory disease that makes walking and activities of daily living difficult. This condition can reduce functional capacity and increase the risk for surgery. Objective: To know the functional capacity of patients with KOA evaluated by the six-minute walk test (6MWT). Method: This cross-sectional study evaluated age, gender, weight, BMI, pain (VAS 90-100), physical disability (WOMAC 0-96), degree of joint damage by radiographic imaging, and 6MWT. Results: A total of 176 patients referred by Orthopedics were evaluated, with the inclusion of 164 participants. The mean age was 61.89 ± 10.62 years, 81% women, 67% with cardiovascular disease, hypertension and/or diabetes, 81% obese, with moderate pain (VAS 47.74 ± 29.27) and according to WOMAC, most had severe or very severe disability. The distance covered in the 6MWT was 354.03 ± 102.03m, 67% of the predicted distance. The maximum heart rate achieved was 107.27 ± 17.71 bpm, which characterizes 68% of the predicted by age. Only 12% of the sample showed a marked drop in oxygenation in the 6MWT and 40% had a recovery heart rate in the 1st minute below 15 bpm. Conclusion: Patients with KOA, who were evaluated by the 6MWT, have low functional capacity and physical deconditioning. ***Level of Clinical Evidence III, Case Control Study.***

Keywords: Osteoarthritis, Knee. Walk Test. Functional Status. Physical Functional Performance. Comorbidity.

RESUMO

A osteoartrite de joelho (OAJ) é uma doença inflamatória incapacitante que dificulta as atividades de vida diária do indivíduo. Esta condição pode reduzir a capacidade funcional e aumentar o risco de cirurgia, caso necessária. Objetivo: Conhecer a capacidade funcional de pacientes com OAJ, avaliada pelo teste de caminhada de seis minutos (TC6M). Métodos: Neste estudo transversal, avaliamos idade, sexo, peso, índice de massa corporal (IMC), dor (escala visual analógica – EVA 90-100), incapacidade física (Western Ontario and McMaster Universities Osteoarthritis Index – WOMAC 0-96), grau de lesão articular por imagem radiográfica e TC6M. Resultados: Foram avaliados 176 pacientes encaminhados pela Ortopedia, com a inclusão de 164 participantes. Na amostra, verificou-se: média de idade de 61,89 ± 10,62 anos; 81% de mulheres; 67% com doença cardiovascular, hipertensão e/ou diabetes; 81% de obesos; com dor moderada (EVA 47,74 ± 29,27); e, segundo WOMAC, maioria com incapacidade intensa ou muito intensa. A distância percorrida no TC6M foi 354,03 ± 102,03 m, sendo esse valor 67% da distância prevista. A frequência cardíaca máxima alcançada foi de 107,27 ± 17,71 bpm, que caracteriza 68% da prevista pela idade. Somente 12% apresentaram acentuada queda de oxigenação no TC6M e 40% apresentaram frequência cardíaca de recuperação no primeiro minuto inferior a 15 bpm. Conclusão: Os pacientes com OAJ, que foram avaliados pelo TC6M, apresentaram baixa capacidade funcional e descondicionamento físico. ***Nível de Evidência III, Estudo de Caso Controle.***

Descritores: *Osteoartrite do Joelho. Teste de Caminhada. Estado Funcional. Desempenho Físico Funcional. Comorbidade.*

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INTRODUCTION

Knee osteoarthritis (KOA) affects about 250 million people worldwide. The condition is inflammatory and can progressively affect the joint, causing joint degeneration. The disease mainly affects women, individuals with obesity and people over 50 years old.[1,2] In the progression of KOA, there may be complaints of disability when performing activities of daily living (ADL) with a progression to physical dependence.[1,3]

KOA has known osteoarticular causative factors and clinical management is complex and may require surgical treatment. Rehabilitation aims to maintain or improve motor function for the

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full return to work functions and ADLs, but the orthopedic process may not be achieved due to other limitations and associated comorbidity.[1,4] Thus, knowing the functional capacity from the six-minute walk test (6MWT) may allow one to recognize the cardiovascular condition of patients with KOA and assist in the process goals for full treatment, aiming at the social impact of rehabilitation.

The 6MWT is a submaximal test of easy application and reproducibility, and for this reason it has been applied frequently. The test is not only used for cardiorespiratory assessment, as it can stratify cardiovascular and surgical risk in patients with various chronic diseases.[5,6] Thus, the objective of this study was to know the functional capacity of patients affected by KOA from the completion of the 6MWT.

MATERIALS AND METHODS

This cross-sectional study was conducted in a tertiary public hospital in the city of São Paulo, after being approved by CAAE under protocol 39890620.5.0000.5479. Data collection took place from January to December 2021.

Patients with a diagnosis of KOA, aged ≥ 18 years, both sexes, randomly referred to physical therapy were included. Patients with heart diseases and/or decompensated lung diseases, previous neurological diseases and patients who could not walk independently were excluded.

Patients diagnosed with KOA were initially asked about the eligibility criteria and acceptance to participate, with the presentation of the study and the informed consent form. All participants were informed that regardless of the study they would receive care and would have the anonymity of the information collected ensured. To ensure data reliability and reduce the risk of data breaches, assessments were archived in the *Research Electronic Data Capture* (REDCap) data management system.

In the evaluation, gender, age (years), weight (kg), height (cm) and comorbidities were collected. The quality of life questionnaire – WOMAC (*Western Ontario and McMaster Universities*) was applied,[7] which evaluates the symptoms and level of physical disability in the last 72 hours (score of zero and 96). The WOMAC interpretation points out that the higher the value achieved, the worse the self-perception. The scale that allows self-assessment of pain in the last 24 hours (VAS of 0-100) was also applied.[8]

Knee lesions were evaluated from the radiographic image and classified according to the degree of impairment,[9] by a blind and previously trained evaluator.

Patients were kept at rest for 30 minutes for subsequent measurement of the variables: heart rate (HR, bpm), blood pressure (BP, mmHg), peripheral oxygen saturation (SpO2, %), self-perceived exertion (adapted Borg – 0-10) and pain in the lower limbs (VAS). Subsequently, the 6MWT was performed,[5,6] in which all patients were instructed to walk continuously for six minutes, at the highest possible speed, without running, in a 30-meter corridor. Before and immediately after the test, HR, BP, SpO2, Borg and VAS were collected. After the test was completed, the first minute of post-test rest (7th minute) was followed to verify patient safety and to calculate the double product (multiplication between HR and systolic pressure) and effort variation (Borg).

The distance covered in the 6MWT was measured and the predicted distance covered was determined by the formula: Distance predicted in the 6MWT: 622.461 − (years of age) + (61.503 × gender men = 1; women = 0).[5,6]

In addition to measuring the distance of the 6MWT, observing the HR behavior throughout the test allows us to assess whether the participants reach 60% of the maximum HR that is calculated from the age of each participant [maximum HR = 220-age(years)].[6]

The statistical analysis of this sample was non-probabilistic by convenience through the database built in the REDCap and transposed to the SPSS program, version 25 for descriptive analysis (absolute and relative), mean and standard deviation.

In the comparison of the means of the distance covered and calculated, the normality analysis was performed by *Shapiro-Wilk*, and compared with the tests: *t Student* and *Wilcoxon* (non-parametric variables) with a significance of 5% ($p < 0.05$). In the correlation analysis, Pearson was used between the distance walked and the variables: pain (VAS), physical disability (WOMAC), BMI and waist circumference.

RESULTS

Among the 176 patients referred, 12 were excluded for declaring heart disease and/or decompensated lung disease, or for not being able to walk without assistance. A total of 164 patients were evaluated, of which: 2.8% had no joint damage at X-ray; 38.6% had grade 1 lesion; 23.9% grade 2; 22.7% grade 3, and 12.5% grade 4. Regarding BMI, 37% had grade 1 obesity, 24% overweight and 20% grade 2 obesity. Other data on clinical and anthropometric characteristics are available in Table 1.

Table 1. Clinical and anthropometric characteristics of the sample of 164 patients with knee osteoarthritis.

VARIABLES	MEAN SD
Age (years)	61.89 ± 10.62
Body mass index (kg/m^2)	32.33 ± 5.67
Abdominal circumference (cm)	101.29 ± 12.11
Female	81.10% (133)
Comorbidities	67.07% (110)
Cardiac disorders	12.80% (21)
Diabetes Mellitus	21.34% (35)
Dyslipidemia	27.43 (45)
Systemic arterial hypertension	56.09 (92)
Obesity	65.85% (108)
Pain at 24 hours (VAS 0-100)	47.74 ± 29.27
Quality of life (WOMAC 0-96)	58.70 ± 19.34

SD: standard deviation; VAS: visual analog scale; WOMAC: Western Ontario and McMaster Universities (questionnaire).

WOMAC, after categorization, presented 6.1% of the sample with little limitation; 25.6% with moderate; 50.6% intense limitation and 17.7% a lot of limitation due to the repercussions of KOA.

In the 6MWT evaluation (n = 164), 10 patients interrupted the test referring pain in the lower limbs. The HRmax reached at the 6th minute was lower than the calculated HRmax (which was expected for the population) with $p < 0.001$.

The distance covered was shorter than predicted ($p < 0.001$) according to reference values for the Brazilian population[10] and are shown in Table 2. In this sample, patients reached 67.90% of the predicted distance, which represented a reduction of 165.78 meters (on average) between the predicted value and the path traveled (Figure 1).

The HR achieved presented a mean of 68.07% of the maximum HR with 9.14% of the sample exceeding 85% of the maximum HR, and 25.60% not reaching 60% of the maximum HR. The difference between HR at the 6th and 7th minute (autonomic nervous system response to physical effort) was less than 15 bpm in 39.63% of patients at the 7th minute.

SpO2 had a variation between rest and the 6th minute greater than 4% in 12.19% of patients during the test. The double product presented an increase of 64.6% in physical demand, and only 4.26%

<< SUMÁRIO

doubled the effort evaluated by this variable. The self-reported effort measured by the Borg was higher after the 6MWT ($p < 0.001$), as well as the VAS in the lower limbs ($p < 0.001$) and the double product ($p < 0.001$).

The correlation of the distance walked with WOMAC was negative ($r -0.409$, $p < 0.001$), as well as in the 24-hour VAS ($r -0.190$, $p = 0.015$), BMI ($r -0.163$, $p = 0.037$), and waist circumference ($r -0.079$, $p = 0.316$).

Table 2. Evaluation of the functional capacity of patients with knee osteoarthritis by the six-minute walk test.

VARIABLES	MEAN SD
Expected distance (m)	519.82 ± 32.03
Distance travelled (m)	354.03 ± 102.03
HR rest	80.17 ± 11.53
HR 6th minute	107.27 ± 17.71
Maximum HR	158.82 ± 10.62
HR recovery	88.15 ± 13.91
HR difference between 6th and 7th minute	19.12 ± 14.70
SpO2 rest	95.71 ± 2.06
SpO2 6th minute	93.82 ± 3.23
SpO2 difference between rest and 6th minute	1.88 ± 2.53
Resting systolic BP	129.84 ± 12.70
Systolic BP 6th minute	149.81 ± 19.89
Double Product rest	10,422.77 ± 1,901.27
Double Product 6th minute	16,143.29 ± 3,813.91
Respiratory effort (Borg) rest	0.68 ± 1.54
Respiratory effort (Borg) 6th minute	4.34 ± 2.46
Lower limb effort (Borg) rest	1.73 ± 2.62
Lower limb effort (Borg) 6th minute	5.59 ± 2.50

SD: standard deviation; HR: heart rate; SpO2: peripheral oxygen saturation; BP: blood pressure.

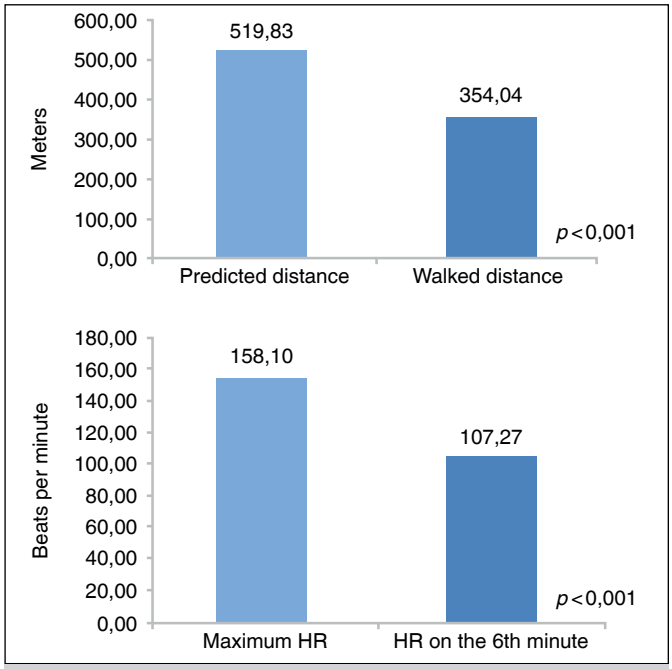

Figure 1. Comparison between averages of the distance covered and predicted, and heart rate achieved and calculated (n = 164).

DISCUSSION

The treatment of KOA involves a series of changes in lifestyle habits, including measures such as weight control, physical activity and physical therapy, oral and intrarticular medications, nutritional supplements, and even joint cleaning measures via arthroscopy, osteotomy or knee arthroplasty.[2,11-13] Thus, the look at these patients has changed over time, with conservative treatment being the first choice today.[2,13] One must know the functional capacity, conditioning and physical limitations to provide much more than rehabilitation focused only on the affected joint, as proposed in this study, which sought to observe functional capacity with a simple and low-cost test such as the 6MWT.

Functional assessment in KOA is important, as pain is an inhibitory symptom.[14] This inhibition can negatively impact the patients' ability to perform daily living activities. Over time, the individual tends to become more sedentary, and further impair their quality of life.[10,13] The 6MWT is a test that allows the observation of gait as a condition of independence, considered as one of the most important.[6,15] Therefore, how to assess the quality of life and the patient within their limitations, without evaluating their independence, gait and functional demand?

Evaluating functional capacity allows the identification of physical fitness, cardiovascular response to exertion, gait performance evaluation according to age and sex, allows the evaluation of risk and prognosis in various clinical conditions, such as cardiovascular and pulmonary diseases, and can even assess morbidity and mortality.[5,6,15,16]

In the search for the best tools for assessing functional capacity in patients with KOA, the 6MWT and the 40-meter walk test are described.[17] The 6MWT is a clinical test that verifies the distance walked and measures cardiorespiratory variables, which allows a more complete assessment of cardiovascular and respiratory condition.[5,6] The 6MWT is commonly used to measure functional capacity before and after clinical trials.[5,6] However, meta-analysis shows that studies often assess the deficit of function by questionnaires.[17] This change in evaluation, with the implementation of the 6MWT, allows us to verify, in addition to the distance walked, physical conditioning and therapeutic effect.[5,6]

The assessment should also contain characteristics such as age, sex, BMI, waist circumference, economic and educational status, and presence of comorbidity, as already described by other authors.[10,18]

What can be seen, in this unicentric sample, was the prevalence of a population aged between the fifth and seventh decade of life, females with high BMI and increased waist circumference, presenting moderate to intense pain by VAS and intense or very intense physical disability by WOMAC.[10,18,19] The sample characteristic is similar to other studies. However, only a low negative correlation was found between the distance covered and WOMAC.

This self-perception of disability may be the result of the decrease in natural muscle strength of age, functional decline resulting from the reduction of ADLs throughout the evolution of the disease and/or the consequence of comorbidity related to OAJ.[4,12,17-19]

In general, these results on functional capacity are only a picture of what is found when evaluating patients with KOA. In the 6MWT, patients on average did not reach 70% of the predicted distance. Our data indicate that pain (VAS) and physical disability (WOMAC) were less evident than the physical deconditioning observed in this group with obesity and cardiovascular comorbidities.

When evaluating patients, it cannot be concluded that KOA is a consequence of obesity, sex and age, or vice versa, this is a cross-sectional study. But it is known that functional disability is not always linked to articular lesions visible on radiographic imaging.[1,8,14]

The functional analysis found in this sample leads us to the second question: can the performance deficit in the distance traveled be explained only by the presence of KOA?

It was found that a quarter of the sample did not reach 60% of the maximum calculated HR, that is, 25% of the patients did not reach a submaximal effort. And the average heart rate endorses functional limitation and cardiorespiratory deconditioning. The SpO2 evaluation throughout the test showed a reduction greater than 4% from the initial value in some patients, conferring a greater risk to them.[5,6] Finally, in the minute of recovery, when evaluating how many beats reduced in this time interval, more than one third of the sample did not show a reduction of even 15 bpm, which in diseases such as pulmonary hypertension, heart failure and obstructive pulmonary disease demonstrate a high risk of death and alteration of the autonomic system in the control of HR.[16]

The SD variation shows that there was an increase in physical effort with a mean of 50% above baseline. The distance covered was low compared to the calculated distance. And finally, the maximum HR reached close to 60% of the calculated maximum. Thus, what can be verified is that there is an important physical deconditioning, in addition to the reduced functional capacity in this sample, with most patients presenting radiographic classification of grade I joint injury. Therefore, little pain can be attributed to this deconditioning. Obesity and waist circumference have also not been shown to be important in the analysis of correlations, as seen by other authors.[18,19] The presence of cardiovascular diseases may demonstrate that the general condition of the sample is more relevant than joint disease, and in the treatment of KOA, attention should be paid to the indication of exercise-based physical therapy, weight reduction and control of comorbidities.[13,18-20] Surgical procedures may be necessary throughout the lives of these patients,[11] and there may be risks related to the cardiorespiratory condition and comorbidities to perform these procedures.[15,16] Understanding the cardiorespiratory condition and limitations in functional capacity may allow the performance of treatment in a safer way, and to treat the patient in a functional way.[5,6,13,15,16] That is, this evaluation can help in the performance of therapeutic exercises and minimize risk in surgical treatment,[15,16] since we know that advanced age, high BMI and the presence of cardiovascular comorbidities may represent a potential risk to patients who require surgical procedures.

CONCLUSIONS

Patients with KOA who were evaluated by the 6MWT have low functional capacity and physical deconditioning.

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HAS THE AGING OF BRAZILIANS IMPACTED THE OCCURRENCE OF OSTEO-CARTILAGINOUS NEOPLASMS?

O ENVELHECIMENTO DO BRASILEIRO IMPACTOU A OCORRÊNCIA DE NEOPLASIAS OSTEO-CARTILAGINOSAS?

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ABSTRACT

Cancer cases and survival have increased significantly in recent decades. Objective: In this study, we sought to evidence whether bone, joint and cartilage neoplasms are increasing with the aging of the Brazilian population, using the analysis of the DATASUS and IBGE databases, between 1979 and 2020. Methods: We compared the means and the proportion of death in Brazil, to observe the confidence interval overlaps, separated by region. Comparison between genders, age group, death and specific rate were compared via proportion tests and the trend was investigated via time series analysis. Results: Through the analyses, we can see that there is an increasing trend of cases, about 2.5 times in the period. Separated by region, the Southeast stands out, with a number of deaths about 6 times higher than other regions. Conclusion: Metastatic carcinoma is the most common neoplasm treated by orthopedic surgeons, and it is essential to adapt to this future projection, with cases of pathological bone involvement resulting from metastatic carcinomas, increasingly present in the routine of orthopedic surgeons. ***Level of Evidence IV, Cross-Sectional Observational Study.***

Keywords: Bone Neoplasms. Joint. Cartilage. Aging. Epidemiology. Brazil.

RESUMO

Os casos oncológicos e a sobrevida aumentaram expressivamente nas últimas décadas. Objetivo: Investigar se as neoplasias de osso, articulação e cartilagem estão aumentando com o envelhecimento da população brasileira, por meio da análise das bases de dado do Sistema Único de Saúde (DATASUS) e do Instituto Brasileiro de Geografia e Estatística (IBGE), entre os anos de 1979 e 2020. Métodos: Realizamos a comparação de médias e de proporção de morte entre as regiões do Brasil para observar as sobreposições de intervalo de confiança em cada região. A comparação entre sexo, faixa etária, óbito e taxa específica foi feita via testes de proporção, e a tendência foi investigada via análise de séries temporais. Resultados: Foi evidenciada uma tendência crescente dos casos de neoplasia, com um aumento de cerca de 2,5 vezes no período analisado. Entre as regiões do Brasil, destacou-se o Sudeste, com número de mortes cerca de seis vezes maior que outras regiões. Conclusão: O carcinoma metastático é a neoplasia mais comum tratada pelos cirurgiões ortopédicos, e é fundamental nos adequarmos a essa projeção futura, com casos de comprometimento ósseo patológicos decorrentes de carcinomas metastáticos cada vez mais presentes na rotina do cirurgião ortopédico. ***Nível de Evidência IV, Estudo Observacional Transversal.***

Descritores: *Neoplasias Ósseas. Articulação. Cartilagem. Envelhecimento. Epidemiologia. Brasil.*

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INTRODUCTION

Cancer is the second leading cause of death in the world and current estimates on the impact of this diagnosis are necessary for planning its control.[1,2] The Global Burden of Disease (GBD) methodology estimated that in 2015 there were 17.5 million cases of cancer with 8.7 million deaths. Cancer incidence has increased by 33% between 2005 and 2015, of which 12.6% were due to population growth and 16.4% due to population aging.[1] Metastatic carcinoma is the most common neoplasm treated by orthopedic surgeons[3,4] and there is evidence that 50% to 80% of carcinoma patients have bone metastases at the time of death.[5,6] Groups C40 and C41 from chapter II of the International Classification of Diseases-Tenth Revision (ICD-10) comprises malignant neoplasms of the bone and articular cartilage of limbs (C40) and of unspecified locations (C41), using the international nomenclature of diseases

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The study was conducted at Centro Universitario Faculdade de Medicina do ABC, Disciplina de Ortopedia e Traumatologia.
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of the World Health Organization (WHO). This group includes primary diagnoses (which were rarer) of malignant bone disease, such as osteosarcomas, chondrosarcomas, fibrosarcomas and Ewing's sarcomas; primary chondral malignant diagnoses, such as chondrosarcoma and, finally, diagnoses of metastatic carcinomas with bone involvement, such as bone metastases resulting from cancer of the breast, prostate, lung, kidney, thyroid, gastrointestinal tract, skin, and others. Today, the demographic projections released by the Population Division of the United Nations (UN) (2019 issue) make it clear that the process of population aging is moving at great strides in the world and at a much greater pace in Brazil.[7] The base of the population pyramid narrowed, while the remaining age groups widened. Thus, the process of population aging gives greater weight to the oncological diseases in the number and proportion of deaths in Brazil; in particular, the understanding of the spectrum of bone metastases is important to plan networks of solutions and treatments for bone diseases occurring in distant sites. In this work, we seek to demonstrate whether neoplasms of bone, joint and cartilage (ICD10: C40/C41) are increasing with the aging of the Brazilian population, using the analysis of the DATASUS database and the Brazilian Institute of Geography and Statistics (IBGE), between 1979 and 2020. As part of the epidemiological transition, the incidence of cancer is expected to increase in the future, further straining limited health resources. The challenge of achieving the proper allocation of resources for cancer prevention, early diagnosis, and curative and palliative care requires detailed knowledge[8-10] of the local burden of bone cancer, as it represents an oncological disease in an advanced stage. The objective of this study is to evaluate in Brazil and its regions the epidemiological profile of deaths, mean death and proportions of death resulting from neoplasms in the bone, cartilage or joint, in the period from 1979 to 2020, using secondary sources available on the public platforms DATASUS and IBGE.

MATERIALS AND METHODS

Our open, publicly available research source was DATASUS, via its open website, in the highlighted section for Health Information (TABNET). We filtered for Vital statistics, Cancer (INCA site) so we could have access to its Atlas of Cancer Mortality.[11] The selected period was the most comprehensive available, from 1979 to 2020, narrowing the selection towards Brazil and its regions (North, Northeast, South, Southeast and Center-West). In each determined research selection, the filter was chosen for both sexes (male and female) and separated by topography by fixed grouping (C40 and C41), that is, neoplasms of bones, joint and articular cartilage. We compared the means and proportion of death between the regions of Brazil, using the following methods: Analysis of Variance (ANOVA)[12] to observe the confidence interval overlaps and differences between each region. Statistical comparison between genders and by age group, by death and specific rate was performed using chi-square ratio tests. The increasing trend was investigated via time series analysis by the Exponential Smoothing and Forecasting method.[13-15] In all the techniques used (Anova, t-test and time series analysis by Exponential Smoothing and Forecasting), all assumptions of normality and homogeneity of variances were checked before performing such analyses.

RESULTS

Through the analysis of time series by the Exponential Smoothing and Forecasting method, we can observe that there is a growing linear trend in the increase in the number of deaths due to bone, cartilage and joint cancer over the years in Brazil; and that, from 1982 to 2020, this number increased 2.5 times. There is also an increasing trend for the next 10 years (Figures 1 and 2).

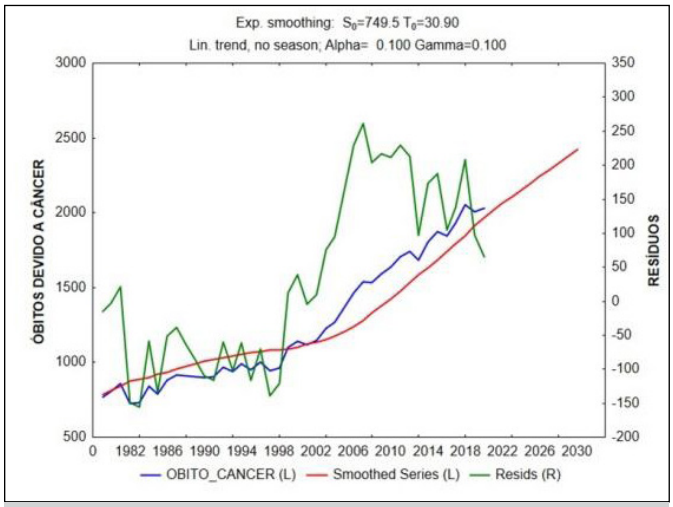

Figure 1. Time trend analysis and projection of deaths over the years.

Time series analysis by the Exponential Smoothing and Forecasting method. In blue: the data series. In red: the smoothed series. In green: the residuals (difference between the actual and adjusted series). There is a vertiginous growing linear trend of the increase in the number of deaths due to cancer over the years in Brazil, and from 1982 to 2020, this number increased 2.5 times; the trend for the next 10 years is also increasing (trend line in red).

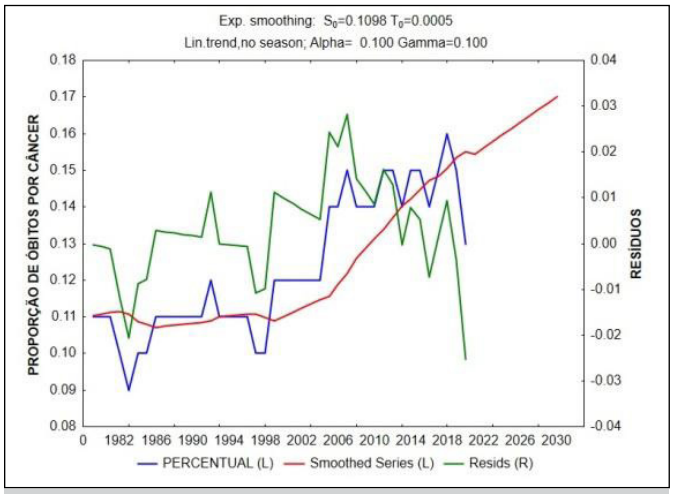

Figure 2. Time trend analysis and projection of the proportions of deaths due to cancer over the years.

Time series analysis by the Exponential Smoothing and Forecasting method. In blue: the data series. In red: the smoothed series. In green: the residuals (difference between the actual and adjusted series). There is a vertiginous increasing linear trend of the increase in the proportion due to cancer over the years in Brazil.

In terms of proportion, there is a vertiginous increasing linear trend of growing proportion due to neoplasms of ICD C40 and C41 in Brazil. The ANOVA technique, comparing the number of deaths due to cancer between the regions of Brazil (Table 1), showed significant statistical differences ($p < 0.001$) (Figure 3).

By overlapping confidence intervals, we can see that the Southeast Region has a much higher number of deaths than the others ($p < 0.0001$), six times higher than the Center-West and North regions. The Northeast and South regions have about half the mortality of the Southeast region ($p < 0.0001$) and triple that of the Center-West and North regions ($p < 0.0001$). When comparing proportion of deaths, the overlap of confidence intervals shows that the South and Center-West regions have a higher proportion than the Northeast, North and Southeast ($p < 0.001$), but not differing among each other ($p = 0.819$). For rate, there are no statistically significant differences when comparing male and female patients in different age groups (Table 2).

<< SUMÁRIO

Table 1. Comparison of cancer death averages between regions of Brazil, evaluated in the period from 1979 to 2020.

REGION	DEATH TO CANCER Mean	DEATH TO CANCER Standard error	DEATH TO CANCER -95.00%	DEATH TO CANCER +95.00%
CENTER-WEST	87.12	5.726	75.55	98.68
NORTHEAST	285.40	25.544	233.82	336.99
NORTH	69.43	6.178	56.95	81.90
SOUTHEAST	572.00	21.321	528.94	615.06
SOUTH	236.90	8.027	220.69	253.12

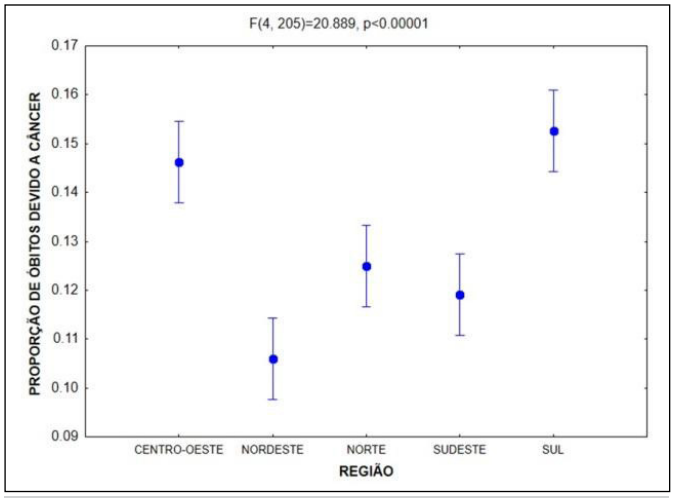

Figure 3. Analysis of variance (ANOVA) comparing the means of death due to cancer between regions of Brazil.

There are significant statistical differences ($p < 0.0001$). By overlapping confidence intervals, we can see that the South and Center-West regions have a higher proportion than the Northeast, North and Southeast ($p < 0.001$), but do not differ among each other ($p = 0.819$). The North and Southeast have a higher proportion than the Northeast ($p < 0.01$).

Table 2. Statistical comparison between the sexes, according to age group, deaths, and rates.

	Male		Female		p	
Age range	Death	Specific rate	Death	Specific rate	p death	p rate
0 to 4	189	0.06	232	0.07	0.03	0.977
5 to 9	400	0.12	423	0.13	0.422	0.984
10 to 14	1.246	0.36	23.130	0.36	< 0.001	1
15 to 19	2.772	0.81	1.614	0.48	< 0.001	0.774
20 to 29	3.008	0.49	1.564	0.25	< 0.001	0.782
30 to 39	1.753	0.35	1.296	0.25	< 0.001	0.897
40 to 49	2.767	0.71	2.023	0.49	< 0.001	0.840
50 to 59	4.903	1.77	3.175	1.05	< 0.001	0.668
60 to 69	5.953	3.4	3.883	1.94	< 0.001	0.527
70 to 79	4.929	5.55	3.697	3.32	< 0.01	0.454
80 or more	2.585	7.91	2.778	5.48	< 0.001	0.506
Age ignored	65	3.83	36	2.08	< 0.001	0.471
Total	30.570	-	21.951	-		

When comparing the two broadest possible periods with the data, between 1979-1983 and 2016-2020, with the comparative t-test, the percentage distribution of total deaths from cancer of bones, joints and articular cartilage presents significant statistical differences ($p = 0.045$), with a lower percentage in the most recent period (2016-2020) (Table 3; Figure 4).

Table 3. Table comparison of percentage distribution of total deaths from cancer of bones, cartilage, and joints.

Period	% Mean	% Standard error	% -95.00%	% +95.00%
1979-1983	1.370	0.111	1.062	1.678
2016-2020	1.040	0.130	0.678	1.402

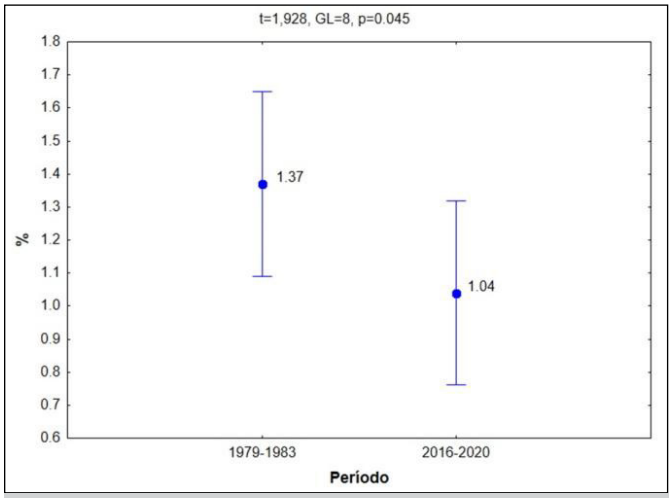

Figure 4. Comparison according to primary location (C40-C41) between the periods 1979-1983 and 2016-2020.

T-test comparing the percentage distribution of total deaths from cancer of bones, joint and articular cartilage. There are significant statistical differences ($p = 0.045$), with the most recent period (2016-2020) having a lower percentage.

DISCUSSION

In 2015, cancer was the cause of more than 8.7 million deaths worldwide and was the second leading cause of death behind cardiovascular reasons. In Brazil, the population aging process has increased life expectancy, and the demographic projections released by the UN Population Division (2019 issue) make it clear that the population aging process is accelerating in Brazil. As a result, the country has seen an increase in cancer cases and has faced the challenge of assisting and treating this demand. By studying country-wide data sources, such as DATASUS and TABNET, for a broad period (1979 to 2020), we were able to separate a topography by fixed grouping (C40, C41: bones, joint and articular cartilage). As such, we achieved a visualization of an epidemiological sampling of a progressive increase in the number of cases, both in raw terms and proportional to the period.

By associating the data in the time series by the Exponential Smoothing and Forecasting method, we observed a vertiginous increasing linear trend of the increase in the number of deaths due to bone, cartilage, and joint cancer over the years in Brazil; from 1982 to 2020, this number increased 2.5 times, and the trend for the next 10 years is growing. We believe that the reason for this trend is aligned with the country's aging process. The data is compatible with the predictions determined in global oncological clinical reviews, such as the one developed by the Global Burden of Disease Cancer Collaboration[1] and it supports the expectation that we will have to deal with more frequent cases of bone metastases

and chronic pain due to bone frailty as well as create increasingly effective solutions for these critical state patients.

Understanding how metastases settle into healthy tissue, evade defense systems, and continue to progress seems to be the key to treating metastatic carcinoma. These data points are fundamental for preparation and anticipation, in terms of treatment[14], of a new reality in Brazilian oncology, which is developing steadily.

According to the database from the United States,[15,16] 5.1% were diagnosed with bone metastasis, which equates to roughly 18.8 per 100,000 bone metastasis diagnoses in the U.S., yearly (2010-2015). For adults, lungs are the most common primary site for cancer, followed by prostate and breast (2015 rates: 3.19 and 2.38 per 100,000, respectively). For patients under the age of 20, endocrine cancers and soft tissue sarcomas are the most common primary site. The data show an increased incidence for prostate cancers in the period. In this study, research was focused on ICD 10 (C40, C41), which includes primary bone tumors (rare) and tumors with metastatic bone involvement, without separation by age. Our perspective on the data is that the increase in cases in the country is in line with the data of this study and, in both cases, being driven by the diagnosis of metastatic bone cancer and not by osteosarcoma, Ewing's sarcoma and other primary sites. We believe that it would be ideal to cross information with databases from the United States and the world; however, the public Brazilian database does not include the specific diagnosis of bone disease but rather groups (ICD 10). Thus, crossing of data of the same nature is currently difficult to perform. This "classification and grouping" system is fundamentally different to those of other countries. In the study by Sugiyama et al.,[17] the cases of identification code C40 and C41(topography) were associated with the International Classification of Diseases for Oncology (ICD-O-3), and histological types were classified according to the 2013 World Health Organization system. In this description, among malignant bone tumors, the most frequent tumor types were osteogenic tumors (201; 39.7%) and chondrogenic tumors (135; 26.7%); these data are in line with previous studies,[18] (without inclusion of bone metastatic involvement, however), and there was no diagnosis of evolution trend (projection) in the number of cases specific to the disease.

CONCLUSION

In this work, we depict a vertiginous increasing linear trend of the increase in the number of deaths due to cancer in bones, cartilage and joints over the years in Brazil. From 1982 to 2020, this number increased 2.5 times, with an increasing trend expected for the next 10 years. In terms of proportion, the increase of deaths due to neoplasms with ICD C40 and C41 in Brazil is also prevalent, and this follows the enlargement of the middle and upper portion of an age pyramid of an aging country. For orthopedic professionals, it is essential to adapt to this new reality with typical cases of epidemiology of patients over 50 years, such as pathological fractures resulting from metastatic carcinomas, increasingly present and creating needs for large therapeutic options in critical patients with little functional reserve.

AUTHORS' CONTRIBUTIONS: Each author contributed individually and significantly to the development of this article. MTK: acquisition, analysis, and interpretation of the data for the work, final approval of the manuscript; GFP, FA: contribution to the design of the work, critical review of its intellectual content; AMS: acquisition, analysis and interpretation of the data for the work, critical review of its intellectual content; RPA, GCB: writing, contribution to the design of the work.

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COMPARISON BETWEEN PORTALS FOR PLACEMENT OF ANCHORS IN SHOULDER INSTABILITY

COMPARAÇÃO ENTRE PORTAIS PARA COLOCAÇÃO DE ÂNCORAS NA INSTABILIDADE DO OMBRO

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ABSTRACT

Objective: to radiographically compare the effects of anchor positioning in the arthroscopic treatment of shoulder instability, in the 3- and 5-o'clock portals. Methods: retrospective study of 36 patients, operated by two shoulder surgeons at the Unimed BH hospital, between January 2013 and January 2018. Each surgeon used only one of either the 3- or the 5-o'clock portal. After postoperative radiographs we performed angle comparisons between the greatest glenoidal axis, the angle of anchor insertion and distance from the inferior pole. Results: the 5-o'clock portal provided better placement than its 3-o'clock counterpart, which allowed for greater orthogonality in relation to the glenoid rim ($p < 0.05$). Conclusion: the 5-o'clock portal allowed for better anchor placement than the 3 o'clock one. ***Level of Evidence II, Clinical Trial.***

Keywords: *Shoulder Dislocation. Arthroscopy. Joint Instability.*

RESUMO

Objetivo: Comparar radiograficamente o posicionamento das âncoras utilizadas no tratamento artroscópico da instabilidade do ombro, através dos portais de 3 ou 5 horas. Métodos: Avaliação retrospectivae de 36 pacientes, operados por dois cirurgiões de ombro do Hospital Unimed BH, entre janeiro de 2013 e janeiro de 2018. Cada cirurgião utilizou apenas uma das técnicas – portal de 3 ou 5 horas. As radiografias pós-operatórias foram avaliadas e comparadas a angulações entre o maior eixo da glenoide, o ângulo de inserção da âncora e a distância em relação ao polo inferior. Resultados: A utilização do portal de 5 horas propiciou a colocação mais adequada das âncoras em relação ao portal de 3 horas, permitindo o posicionamento mais ortogonal em relação à borda da glenoide ($p < 0,05$). Conclusão: A utilização do portal de 5 horas apresenta melhor posicionamento das âncoras quando comparado ao portal de 3 horas. ***Nível de evidência II, Ensaio Clínico.***

Descritores: *Luxação do Ombro. Artroscopia. Instabilidade Articular.*

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INTRODUCTION

Capsulolabral reinsertion of the glenoid was first described by Bankart[1] for the treatment of anterior shoulder dislocation. Open repair with curved needles used to be the standard; nowadays, though, the modernization of techniques and surgical materials led to a gradual presence of arthroscopy in surgical treatment of shoulder instability.

Traditionally, anterior anchors in the glenoid are placed through the anteroinferior portal (3-o'clock position) which provides optimal access to the anterior face of the glenoid; however, it is sometimes difficult to place the anchor in the most inferior face of the glenoid due to the acuteness of the angle of insertion in the inferior pole.[2,3] Due to this, some authors recommend use of the trans-subscapularis portal (5-o'clock position), which allows for optimal angulation during the insertion of said anchor. Another reason that popularized the placement of anchors through the 3-o'clock portal is the proximity to important vasculonervous structures in the anteroinferior shoulder face.[2] However, the orthogonal placement of the anchor in relation to the glenoid rim promotes greater tensile strength.[3,4] Recent studies in cadavers show that orthogonal anchor insertion has greater resistance to avulsion.

Number and position of the anchors placed for the reinsertion of the capsulolabral complex are also fundamental for the success of the surgery.[5] The anchor placed between the 5- and 6-o'clock positions is the most important for restoration of the anatomical stability of the shoulder.[6,7]

Davidson, Tibone and Resch described the trans-subscapularis portal to achieve a more perpendicular anchor placement in relation to the glenoid rim, in the anteroinferior quadrant of the glenoid. While Davidson and Tibone[3] described the "inside out" technique, Resch described the "outside in" technique. However, they recommend the use of the 5-o'clock portal due to the possibility of cephalic vein injury and/or chondral injury to the humeral head.[3,8,9]

All authors declare no potential conflict of interest related to this article.

The study was conducted at Hospital Unimed BH, Serviço de Ortopedia e Traumatologia.
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This study seeks to radiographically compare anchor positioning in arthroscopic treatment of shoulder instability in both the 3- and the 5-o'clock portals.

MATERIALS AND METHODS

We retrospectively evaluated 36 patients submitted to arthroscopic reinsertion of the capsulolabral ligament complex to the glenoid by two assistant surgeons from the field, from January 2013 to January 2018. The allocation criteria for each patient varied by surgeon, and each professional used only one of the techniques. A total of 12 patients were operated by the conventional technique of reinsertion of the capsulolabral complex through the portal above the subscapularis tendon (3-o'clock portal) and 24 through the trans-subscapularis (5-o'clock portal). The study was approved by the Ethics Committee, available on Plataforma Brasil by protocol number CAAE: 10008312.7.0000.512

All patients were operated in the beach-chair position, under interscalene brachial plexus block and general anesthesia. After general asepsis, the shoulder to undergo surgery as well as the ipsilateral upper limb were submitted to asepsis and put in a mechanical traction device. A posterior portal 2 cm distal to the posterolateral angle of the acromion was initially created for inspection of the joints; surgery was performed with a 30° arthroscope.

The two portals for instrumentation (3-o'clock superior to the upper edge of the subscapularis and 5-o'clock at the junction of the middle third with the distal third) (figure 1) (figure 2) were carried out via the "outside in" technique, by verifying the best positioning of the portal with a percutaneous needle and subsequent creation of the portal with a No. 11 scalpel and arthroscopic cannula.

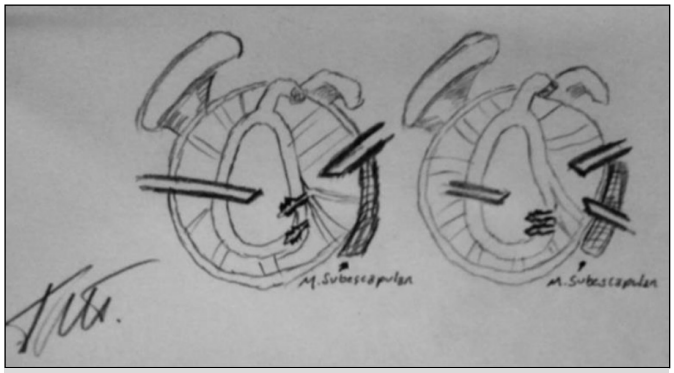

Figure 1. scheme showing the angle of insertion at the 3- and 5-o'clock portals.

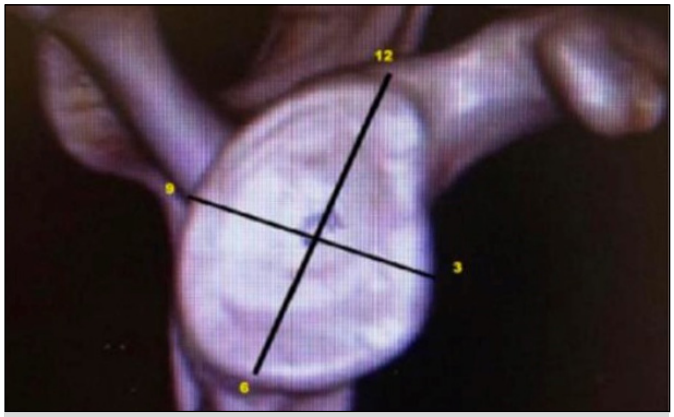

Figure 2. spatial positioning of anchors, how to measure. The upper point is 12-o'clock, the lower one is 6-o'clock, the one on the right is 3 o'clock, and the one on the left is 9-o'clock.

Then, the glenoid was approached with the initial anchor perforator until the anchor was completely inside the glenoid rim. The capsuloligamenty repair followed the placement of one anchor for each 1 cm of injury, with mattress-type suture following the repair. The patient was then immobilized with a VEUPEAL arm sling for 6 weeks. In the first postoperative week, a true anteroposterior X-ray of the operated shoulder was performed, and the stitches were then removed.

All care before, during and after the procedure was identical between the groups, the only difference being the portal of insertion.

The radiographic assessment of anchor (figure 3) positioning was performed by a single physician, who was previously trained and did not know the method used. Two measurements were made:

Figure 3. True anteroposterior radiograph showing anchor positioning.

The angulation between the supero-inferior axis of the glenoid (figure 4) and the greatest axis of the anchor which we considered the angle of anchor insertion (figure 5).

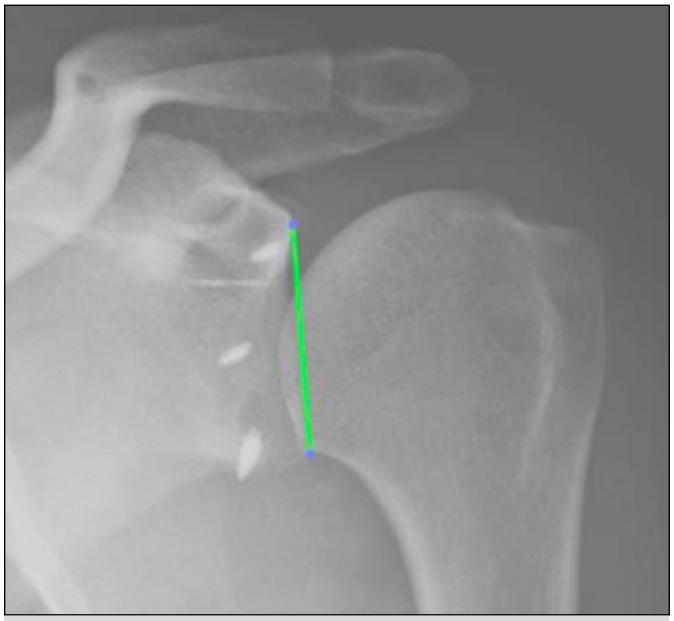

Figure 4. establishment of the long axis of the glenoid.

<< SUMÁRIO

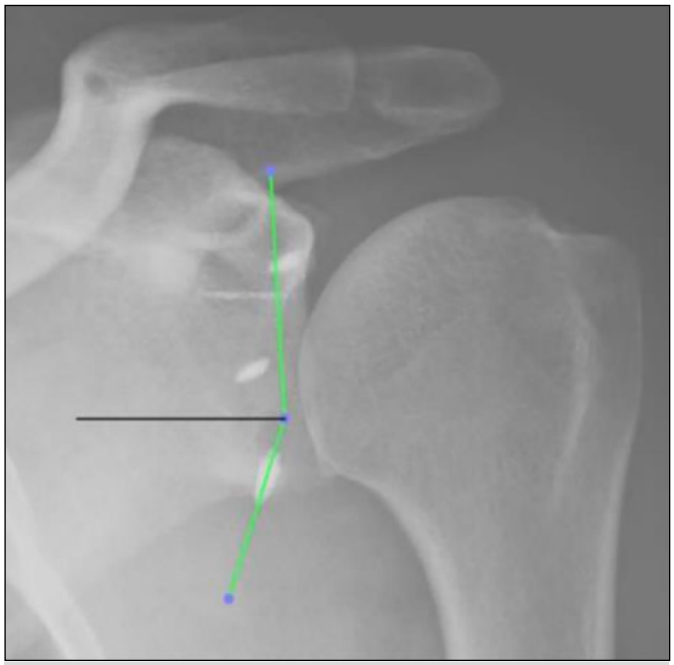

Figure 5. measurement of the angle with the greatest axis of the anchor. Angle = 69.4º

The distance between the anchor head and the lower pole of the glenoid measured as a percentage in relation to the same supero-inferior axis of the glenoid (figure 6) was taken to eliminate failures due to changes in distortions arising on radiographs (example: ampoule distance).

Figure 6. percentage measurement of anchor positioning.

Anchors that were partially or completely outside the bone were considered lost. All measurements were performed by a single assistant physician, who was not aware of the method used at the time of surgery.

The measurements were taken via the OsiriX v5. 7 – 32 Bit Switzerland software and for the statistical evaluation we used the GraphPad Prism 7 for Mac USA software. We used ordinal variables for Student's t-test and categorical variables for Fischer's test; and considered a significance of $p < 0.05$.

RESULTS

We observed 12 patients from the 3-o'clock portal (Group 1) and 24 from the 5-o'clock portal (Group 2).

In Group 1, there was 11 male patients and one female with mean age of 28.08 years; in Group 2, 22 were male and two were female while the mean age was 29.52 years. This makes the two groups homogeneous.

The comparison of the angles means between Group 1 and 2 of the first anchor presented $p < 0.0001$, while values for the second anchor were $p = 0.0005$ and for the third anchor $p = 0.0019$. The comparison of the means of the distance between Groups 1 and 2 in the first anchor presented a significance of $p = 0.0189$, while for the second anchor it was $p = 0.1265$ and for the third anchor $p = 0.7007$.

Regarding the number of anchors lost, the comparison between the groups presented $p = 0.4407$.

DISCUSSION

Due to technical and material advances in the arthroscopic treatment of instability, arthroscopic Bankart repair has become widespread and has approached the previous gold standard, that is, open repair. The arthroscopic approach to the anteroinferior aspect of the glenoid rim is decisive for the success in the treatment of instability due to the positioning of the cannula, which allows an optimal angle of insertion to the anteroinferior edge of the glenoid.[10-13] In agreement with Dwyer et al.,[14] we observed that the 5-o'clock portal method is safe, reproducible and allows better anchor positioning when compared to its 3-o'clock counterpart. The present study corroborates this assertion, as it was observed that in the group operated by the 5-o'clock portal the anchors were positioned more orthogonally, which implies a mechanical advantage in avulsion resistance.[15]

Khan et al.[15] proved that the penetration of the subscapularis by a 5 mm anchor or 8 mm cannula does not produce a deleterious effect on the tendon and it is safe, respecting the distance from the neurovascular structures. As this method does not harm the tendon like in open surgery, there is a potential advantage of fewer complications related to the integrity of the subscapularis tendon.[14,16] Khan et al.[15] also have proven that the use of portals through the rotator cuff does not cause significant anatomical and/or functional injuries to the patient.[16] Many variables are currently studied as a prognostic factor for the success of surgical treatment without, however, consensus on the individual value of each variable, such as positioning, type and number of anchors, formation of a "new flap" with mechanical use in shoulder stabilization, restoration of the proprioceptive reflex of the joint, and postoperative immobilization time.[5-7] As well as the association between the positioning of the portals.[12,14-16] This study presents as strengths the reproducibility of the measurements, the homogeneity of the groups and the fact that it was evaluated by a single physician unaware of the type of procedure performed. One of this study's weakness was the fact that it was not randomized.

CONCLUSION

The results showed that the use of the trans-subscapularis portal (5-o'clock position) was safe with respect to neurovascular structures and improves the anchor positioning in the anteroinferior aspect of the glenoid when compared to the anteroinferior portal (3-o'clock position), allowing a more orthogonal placement of the same.

AUTHORS' CONTRIBUTIONS: Each author contributed individually and significantly to the development of this article. JCSV, TLAM: surgery; IDA: intellectual concept of the article; MAC, ALAV: data analysis, review, and submission of the article; TFB: writing and data analysis of the article.

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WHAT IS THE EPIDEMIOLOGICAL PROFILE OF ACUTE HAND INFECTIONS AT A HOSPITAL IN SAO PAULO?

QUAL O PERFIL EPIDEMIOLÓGICO DE INFECÇÕES AGUDAS NA MÃO NUM HOSPITAL FILANTRÓPICO DE SÃO PAULO?

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ABSTRACT

Objective: To determine the epidemiological profile of patients treated at a philanthropic hospital specialized in Orthopedics and Traumatology, located in a significant urban center, and evaluate the efficacy of initial empirical antibiotic treatment. Methods: Patients diagnosed with hand infections from September 2020 to September 2022 were included, excluding cases related to open fractures or post-surgical infections and those with incomplete medical records. The chi-square test was performed using STATISTICA® software to correlate various variables. Results: A total of 34 patients participated, including 24 men and 10 women, with an average age of 41.9 years. Most male patients had Diabetes Mellitus, HIV, and drug addiction, and they resided in urban areas. Half of the patients did not report any apparent trauma. The most common infectious agent was *Staphylococcus aureus*. Nearly 62% of patients required a change in the initial antibiotic regimen, with Penicillin being the most frequently substituted medication. Beta-lactam antibiotics and Quinolones were the most effective. Conclusion: These results suggest the importance of carefully evaluating the epidemiological profile of patients with acute hand infections and improving initial empirical treatment to ensure appropriate and effective therapy. ***Level of Evidence IV, Cross-Sectional Observational Study.***

Keywords: Bacterial Infections. Hands. Epidemiology. Anti-Bacterial Agents. Orthopedics.

RESUMO

Objetivo: Determinar o perfil epidemiológico de pacientes atendidos em um hospital filantrópico referência em Ortopedia e Traumatologia localizado em um centro urbano importante, e avaliar a eficácia do tratamento antibiótico empírico inicial. Métodos: Foram incluídos pacientes com diagnóstico de infecção na mão, atendidos no período de setembro de 2020 a setembro de 2022, excluindo-se casos relacionados a fraturas expostas ou pós-cirúrgicas e aqueles com prontuários incompletos. Realizou-se o teste do qui-quadrado, utilizando o software STATISTICA® para correlacionar diversas variáveis. Resultados: Participaram do estudo 34 pacientes, sendo 24 homens e 10 mulheres, com média de idade de 41,9 anos. A maioria era de homens, com alta incidência de diabetes mellitus, HIV e drogadição, que residiam em áreas livres. Metade não relatou trauma evidente. O agente infeccioso mais comum foi o Staphylococcus aureus. Aproximadamente 62% dos pacientes precisaram de troca do esquema inicial de antibióticos, sendo a penicilina o medicamento mais frequentemente substituído. Os antibióticos beta-lactâmicos e quinolonas foram os mais eficientes. Conclusão: Esses resultados sugerem a importância de avaliar cuidadosamente o perfil epidemiológico dos pacientes com infecções agudas na mão e aprimorar o tratamento empírico inicial para garantir uma terapia adequada e eficaz. ***Nível de Evidência IV, Estudo Observacional Transversal.***

Descritores: *Infecções Bacterianas. Mãos. Epidemiologia. Antibacterianos. Ortopedia.*

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All authors declare no potential conflict of interest related to this article.

The study was conducted at the Irmandade Santa Casa de Misericordia de Sao Paulo, Department of Orthopedics e Traumatology "Pavilhao Fernandinho Simonsen," Hand and Microsurgery Group.
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INTRODUCTION

Hand infections are common diagnoses in orthopedic clinical practice.[1] They represent 1/3 of the patients admitted to hand surgery services, and it is estimated that 60% of hand infections are posterior to trauma, of which 30% result from human or animal bites and 10% from other causes, such as drug injection.[2] Most patients seek the health services due to pain, which is commonly associated with redness, edema, heat, and erythema.[3] Pain is most often the initial symptom, followed by edema, redness and local warmth.[3]

Acute hand infections usually begin due to a breach of the skin integrity as result of an unnoticed injury. Diabetes mellitus, immunosuppression, malnutrition, alcoholism, and drug abuse are risk factors for the emergence of hand infection.[4] The patient's age is also an important risk factor for hand conditions.[4] Most infections result from injuries in the home or workplace and involve Gram-positive bacteria. *Staphylococcus aureus* is the most frequently isolated microorganism found in hand infections; it is identified in 44–80% of cases in other studies.[5-7] There has been an increase in the incidence of methicillin-resistant *Staphylococcus aureus* (MRSA) in the last 15 years, with its incidence estimated at about 65%.[8,9]

It is believed that the distribution of different infections is related to the epidemiological profile of the population cared for in a specific service. This study seeks to establish the epidemiological profile of patients with acute hand infections who are treated in a reference philanthropic hospital of Orthopedics and Traumatology located in a major urban center. The other purpose of this research is to evaluate the effectiveness of initial empirical antibiotic treatment.

METHODOLOGY

This is a cross-sectional observational study of epidemiological data of patients with acute hand infections, who attended the previously described service, from September 2020 to September 2022. The study was approved by the Research Ethics Committee under opinion No. 5,818,523 and all patients signed an informed consent form. The data were collected via medical records, with relevant information being transferred to an Excel® file.

The inclusion criteria were: hand infection diagnoses. Infections after an open or post-surgical fracture were excluded, as were patients with incomplete or inaccurate medical records.

Regarding epidemiological data of the patients, gender, occupation, comorbidities, history of alcoholism or drug use, housing conditions (public area or not) and trauma mechanisms were evaluated; when applicable, age was also evaluated. For age, patients were allocated into three groups: three to 34 years (nine subjects), 35 to 47 years (12 subjects) and 50 to 68 years (13 subjects). Infections were classified according to the affected tissue and site. Type of trauma, when present, was also a criterion of investigation.

For infection characterization, the following data were retrieved: infectious agent, exam results of C-reactive protein (CRP) and erythrocyte sedimentation rate (ESR), as well as the antibiotic applied at the entrance, and failures that led to medication change.

Lastly, the chi-square test was carried out using the STATISTICA® software for the following correlations: drug use *versus* mechanism of trauma; alcohol use *versus* mechanism of trauma; age *versus* microorganisms isolation; living and working conditions *versus* microorganisms isolation; drug use *versus* isolation of microorganisms; diabetes mellitus *versus* microorganisms isolation; alcohol use *versus* microorganisms isolation; mechanism of trauma *versus* microorganisms isolation; age *versus* effectiveness of the initial antibiotic; living conditions *versus* effectiveness of the initial antibiotic; drug use *versus* effectiveness of the initial antibiotic; diabetes mellitus *versus* effectiveness of the initial antibiotic; alcohol use *versus* effectiveness of the initial antibiotic; mechanism of trauma *versus* effectiveness of the initial antibiotic; microorganisms isolation *versus* effectiveness of the initial antibiotic and initial antibiotic *versus* effectiveness of the initial antibiotic.

RESULTS

A total of 34 patients met the inclusion criteria, 24 men (70.6%) and 10 women (29.4%). No individuals were excluded. The mean age of these patients was 41.9 years, ranging from three to 68 years (standard deviation = 11.1). As for housing, 10 patients (29.4%) were residents of public areas (including four recyclers and six unemployed individuals). We also observed the presence of three retirees (8.9%), three students (8.9%) and two individuals with unspecified profession (5.8%) (Table 1).

Table 1. Occupational and housing conditions of the individuals evaluated by the study.

Profession	Total
Health worker	1
Retiree	3
Kitchen assistant	1
Business owner	3
Caretaker	1
Unemployed (public area resident)	6
Homemaker	1
Electrician	1
Student	3
Vendor of farm products	1
Plasterer	1
Valet	1
Unspecified	2
Construction worker	1
Painter	1
Door attendant	1
Recycler (public area resident)	4
Security guard	1
Computer technician	1
Overall Total	**34**

Figure 1 lists the comorbidities presented by these patients. The most common comorbidity was diabetes mellitus, affecting nine patients (26.5%); HIV was the second most prevalent, in three patients (8.9%). Regarding habits, 17 patients reported drug use (50%) and 11 patients reported being alcohol users (32.4%).

Among the 34 evaluated patients, 47% reported no previous trauma, 14.7% reported blunt trauma and 14.7% had perforating trauma. Human and cat bites accounted for 9% of cases each, totaling three cases. The other mechanisms of trauma are shown in Figure 2.

The most frequent hand infections according to Table 2 were: 12 cases of flexor tenosynovitis (32.4%) and four cases of extensor tenosynovitis (10.8%). Table 2 also show the other diagnoses.

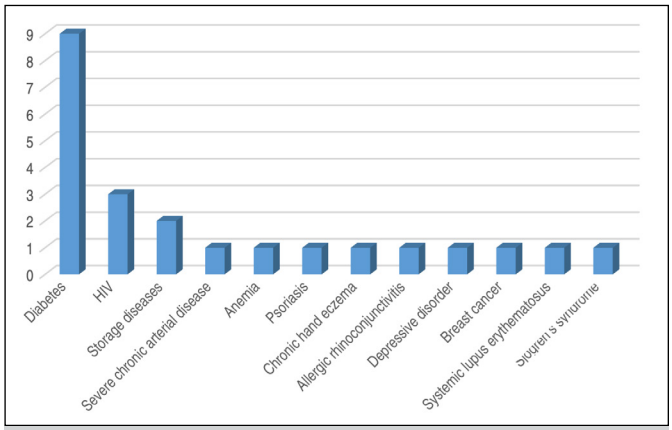

Figure 1. Comorbidities presented in order of prevalence.

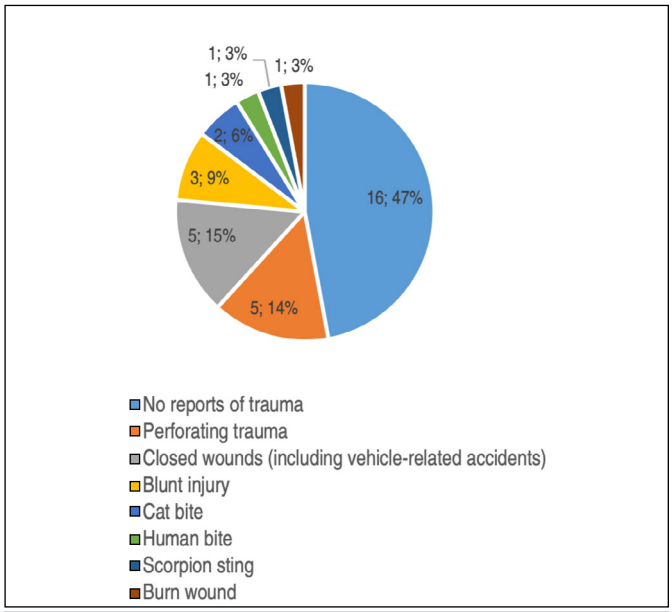

Figure 2. Mechanism of trauma in order of prevalence.

Table 2. Description of the diagnosis and site of infection of the evaluated patients.

Diagnosis	Number	Percentage
Abscess on the distal phalanx	1	2.7%
Abscess on the intermediate phalanx	2	5.4%
Abscess on the proximal phalanx	2	5.4%
Abscess in the first commissure	1	2.7%
Abscess in the dorsal wrist	1	2.7%
Abscess in the dorsal metacarpophalangeal region	1	2.7%
Abscess in the thenar region	2	5.4%
Abscess on the volar zone of the thumb	2	5.4%
Metacarpophalangeal cellulitis	1	2.7%
Subungual abscess	1	2.7%
Distal phalanx necrosis	2	5.4%
Distal phalanx necrosis + ink-machinery-related accident/foreign-body	1	2.7%
Distal phalanx osteomyelitis /paronychia	1	2.7%
Distal interphalangeal pyoarthritis – human bite	1	2.7%
Proximal interphalangeal pyoarthritis – cat bite	1	2.7%
Extensor tenosynovitis	4	10.8%
Flexor tenosynovitis	12	32.4%

Staphylococci species were the most prevalent, with *S. aureus* occurring in 26.5% of cases and coagulase-negative in one (3%). Cultures were negative in 53% of cases.

In laboratory analysis, it was observed that 28 patients (82.4%) presented changes in CRP, with values ≥ 1, ranging from 1 to 36.7 (standard deviation = 13.82), while 24 (70.6%) demonstrated changes in ESR, with values above 13 for men and 20 for women, ranging from 4 to 120 (standard deviation = 36.26). Exam collection was not possible for two patients (5.9%).

The following significant relationships were obtained: (1) drug use versus the need for change in antibiotic; (2) infectious agent versus need for change in antibiotic; and (3) initial antibiotic class versus need for change in antibiotic. The results revealed significant associations between the variables analyzed and the need to change antibiotic. In the case of drug use, the total chi-square (39.20) was higher than the critical value (3.841), indicating a relevant association between this variable and the need to change antibiotics in the studied group. Similarly, for the infectious agent, the total chi-square (9.5152) was higher than the critical value (7.815), demonstrating a significant association between the type of infectious agent and the need for change in antibiotic. Furthermore, in relation to the initial antibiotic class, the total chi-square (100.5273) was higher than the critical value (12.592), indicating a strong association between this variable and the need to change antibiotics in the analyzed group. For the other associations, no statistical significance was found; the age group that most needed change in antibiotic was those aged 50 to 68 years (61.5%), with eight patients who needed such change (standard deviation = 3.96), while in the age group from three to 34 years there was a need for change in 44.4% of patients (standard deviation = 8.81) and in the age group from 35 to 47 years in 25% of patients (standard deviation = 4.29).

DISCUSSION

Hand infections, when not properly identified and treated, can result in tissue damage, loss of function, and even permanent disability, leading to significant morbidity and mortality rates.[10]

In this study, we found a predominance of infections in male patients (70.6%), agreeing with what has been described in the literature in the past 20 years.[4]

Patient's age is a key factor in hand infections. In our study, the ages ranged from the first decade of life to the sixth decade. According to Flevas et al.[11] older patients with degenerated vessels, poor perfusion, and weakened skin barrier are more likely to attend health services with infected upper limb conditions. To Gafur et al.[12] newborns are also prone to hand infections due to immature immune systems and sharp nails that can hurt their fingertips.

Patients with hand infections are often individuals who engage in handwork, such as farmers, animal breeders, bricklayers, fishers, and water sports athletes.[10,11,13] In addition, medical professionals such as dentists and surgeons are also susceptible to hand infections.[10,11] It is important to highlight that manual workers who do not have adequate hand protection—often due to financial condition—also face risks of infection due to poor-quality equipment.

The health service where this study was conducted is in the central region of the city, close to areas with high population density and poor living conditions. Therefore, the studied sample corresponds to a socioeconomically vulnerable population.

Malnutrition and poor hygiene were observed in a considerable proportion of patients, including those living on the streets. Moreover, we observed a high percentage of patients who were drug users (50%), surpassing the statistics found in the literature.[5] Notably, unlike the more common report of injectable drug use, such as that of Houshian, Seyedipour and Wedderkopp,[5] the main drug used by the population in this study was crack cocaine. The use

of this substance is intricately linked to the manipulation of sharp objects during its consumption, increasing the risk of hand trauma. In our study, we found that 47% of patients had no identified traumatic event, while bites represented only 9% of cases. Note that, there is a possibility of bias due to improper filling of medical records and the accuracy of information obtained from patients. However, in 14 cases (41.1%), an additional risk factor was identified, such as diabetes, HIV, or living in extremely poor areas, suggesting a possible protein-related malnutrition. Several studies report the adverse effects of malnutrition on wound healing and infection progression.[14,15]

According to previous studies,[2,5,6,16] the most common pathogens in hand infections are the *Staphylococcus aureus* and the coagulase-negative *Streptococci*. In our sample, we observed that *Staphylococci* were the most prevalent, with *S. aureus* present in 26.5% of cases, and only one case of coagulase-negative *Staphylococcus* (2,9%). We also found a high rate of negative cultures (53%), whilst the literature reports a range of 10–30%.[2,5,6,16] The number of insufficient samples and inadequate culture methods, such as the use of agar-agar medium without investigating other agents that require specific means or insufficient evaluation time, may explain the high rate of missing results in this study, which might be a diagnostic bias, as previously indicated.[17] Due to our sample including a significant number of immunocompromised patients, there is a higher chance of atypical pathogens or the involvement of multiple agents, which require targeted investigation methods. This is highlighted by the fact that there was more than one case of associated infection with *Streptococcus viridans* and *Morganella morganii*.

Among the positive cultures of drug users, five had infections caused by *Staphylococcus aureus* (83.3%), while only one was caused by beta hemolytic *Streptococci* (16.7%). These findings are in accordance with Dastagir et al.[16] As aforementioned, this association is related to the type of drug used. In the literature,[5] injectable drugs have a greater association with the development of infections. In our sample, however, we observed a different pattern, as crack cocaine was the most reported drug.

A surprising finding in this study was a significant percentage of patients who required a change in the initially used antibiotics. The hospital protocol regarding the Infectious Diseases service recommends the intravenous administration of ciprofloxacin associated with oxacillin as empirical antibiotic therapy, immediately after culture collection. This protocol seeks to provide broad antibacterial coverage for both Gram-positive and Gram-negative germs. In 21 cases (61.8%), it was necessary to change antibiotic therapy based on the results of the cultures. As described by Intravia, Osterman and Tosti,[17] 12 patients (35.2%) who started treatment with ciprofloxacin and oxacillin, according to the recommended schedule, needed to change antibiotic therapy. It is relevant to discuss whether the high rate of negative cultures—with possible atypical agents—influenced this change, considering that the sample of the our study differs from the literature.

There is a positive correlation between CRP levels and the severity of the infection, as well as the extent of the affected areas, according to Rasnake and Dooley.[18] In our study, despite some patients' malnourishment, most showed an initial increase in CRP and ESR values. However, due to the significant loss of follow-up, it was not possible to establish a correlation between clinical evolution and laboratory parameters.

The statistical results revealed valuable information about the association between different categories of antibiotics and the need for changing the medicine. Penicillin, first generation cephalosporin, sulfonamide and diaminopyrimidines required more changes than other categories. Notably, among these four categories, penicillin was the least efficient. Also, in Gram-negative infections, followed by fungus and negative cultures were more associated with change in antibiotic.

On the other hand, beta-lactam and quinolone were the most effective, and we did not find a microorganism that needed fewer changes in antibiotic. However, it is essential to consider other clinical and individual factors in the choice of treatment, and the decision should be taken by a health professional based on all the particularities and needs of each patient.

Finally, the age group that most needed a change in antibiotic was the 50 to 68 years old group. Although there was no significant relevance, there was a greater tendency to change antibiotics in this age group. To obtain more robust conclusions, it would be essential to have a larger sample. In Stromberg's seminal work,[19] from 1989, it was suggested that, compared to younger populations, antibiotic sensitivity is consistently lower in older adults. This study was later corroborated by Heppner et al.[20]—some 20 years later—when they found that the prevalent microbiology of infection changes with aging, leading to differences in optimal antimicrobic protocol for severe infections.

CONCLUSION

Patients with hand infections were mostly men, with a high incidence of diabetes mellitus, HIV and drug addiction, living in public areas. Almost half individuals did not report evident trauma. *Staphylococcus aureus* was the most common agent. In 61.8% of cases, change in the initial antibiotic regimen was necessary. Penicillin was the least efficient, while beta-lactam and quinolone were the most. Gram-negative patients needed more changes in antibiotics.

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RANGE OF MOTION AFTER BONE BLOCK PROCEDURES FOR SHOULDER INSTABILITY: SYSTEMATIC REVIEW

ARCO DE MOVIMENTO APÓS BLOQUEIO ÓSSEO PARA INSTABILIDADE DO OMBRO: REVISÃO SISTEMÁTICA

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ABSTRACT

Objective: to determine the surgical indications for glenoid bone grafting associated with better postoperative ranges of motion. Methods: This systematic review was conducted according to PRISMA. The included studies were subdivided according to the criteria used to indicate glenoid bone graft surgery: group for radiological indications only (Group R), group for radiological indications associated with clinical indications (Group R + C), and group for arthroscopic indications (Group A). The extracted and evaluated data were the range of motion of the shoulder. Results: in the electronic search conducted in October 2022, 1567 articles were selected. After applying the inclusion criteria, 14 articles were selected for the systematic review. Regarding the ranges of motion, group A had the highest number of statistically positive results together with group R. Group A showed positive results in elevation parameters, loss of lateral rotation in adduction, and medial rotation in abduction. Group R showed positive results in lateral rotation in adduction and loss of lateral rotation in adduction. On the other hand, Group R + C was the one that presented the highest number of statistically negative results, in the following parameters: elevation, lateral rotation in abduction, loss of lateral rotation in adduction, and medial rotation in abduction. Conclusion: the subgroups presented variable results in the evaluated parameters; however, the groups with arthroscopic and radiological indications showed the highest number of positive results, with the latter group showing the best results regarding lateral rotation. ***Level of Evidence II, Systematic Reviews.***

Keywords: Shoulder. Systematic Review. Orthopedic Surgery.

RESUMO

Objetivo: Determinar as indicações cirúrgicas de enxertia óssea da glenoide associadas aos melhores arcos de movimento no pós-operatório. Métodos: De acordo com o Preferred Reporting Items for Systematic Reviews and Meta-Analyses (PRISMA), 14 artigos de um total de 1.567, selecionados em busca eletrônica, foram escolhidos para a revisão sistemática. Os estudos incluídos foram subdivididos de acordo com os critérios de indicação da cirurgia: indicações somente radiológicas (grupo R), indicações radiológicas associadas a indicações clínicas (grupo R + C) e indicações artroscópicas (grupo A). Os dados avaliados foram os arcos de movimento do ombro. Resultados: Em relação aos arcos de movimento, os grupos que apresentaram a maior quantidade de resultados estatisticamente positivos foram o A – parâmetros elevação, perda de rotação lateral em adução e rotação medial em abdução – e o R – parâmetros rotação lateral em adução e perda de rotação lateral em adução. O grupo R + C apresentou a maior quantidade de resultados estatisticamente negativos nos parâmetros elevação, rotação lateral em abdução, perda de rotação lateral em adução e rotação medial em abdução. Conclusão: Os grupos de indicações artroscópicas e radiológicas apresentaram a maior quantidade de resultados positivos, sendo que o último apresentou os melhores resultados em relação à rotação lateral. ***Nível de Evidência II, Revisão Sistemática.***

Descritores: *Ombro. Revisão Sistemática. Cirurgia Ortopédica.*

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INTRODUCTION

Anterior shoulder dislocation is a complication to the evolution of recurrent shoulder instability and occurs in up to 60% of patients.[1,2] Determining the best surgeries for anterior shoulder instability is controversial, with several procedures created over time. According to studies, Bankart surgery, also known as anatomical repair, is the initial procedure in cases of anterior shoulder instability, being chosen in more than 90% of cases.[3,4]

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The study was conducted at the Federal University of São Paulo, São Paulo School of Medicine, Center of Sport Traumatology.
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The popularity of open Bankart repair has led to the development of the efficient arthroscopic Bankart repair, which has a recurrence rate of 6% and a review rate of 4.7% according to a systematic review.[5] Nevertheless, Burkhart and De Beer[6] have shown that the recurrence rate of instability was 67% in patients with large bone lesions (Bankart or Hill-Sachs) who underwent Bankart surgery and 89% in contact athletes with the same disease. This suggests that the effectiveness of Bankart surgery may be limited in the presence of bone lesions.

Consequently, the number of indications for glenoid bone graft surgery has increased. Initial studies of this type of surgery demonstrated a recurrence rate of 10% and surgical review rate of 14% in the Latarjet technique,[7-9] with some institutions abandoning this procedure.[10] However, recent studies have shown better success rates. A systematic review by Griesser et al.[11] has shown a recurrence rate of 2.9% and a subluxation rate of 5.8%. Specifically, in patients with bone lesions, the Latarjet technique had a recurrence rate of 4.7%, demonstrating superiority over anatomical surgery.[12] Nevertheless, the Latarjet technique is associated with a high rate of complications, occurring in up to 30% of cases.[11]

In previous studies, glenoid bone grafting surgeries have shown lower recurrence rates and good functional results, making them frequently indicated. However, they are associated with complications such as neurological injuries and development of shoulder arthrosis. Thus, this systematic review mainly aimed to determine which indications for glenoid bone grafting surgeries are associated with better results in relation to arcs of movement in the postoperative period, helping in the appropriate choice of this modality of surgery.

Previous systematic reviews evaluated different aspects of glenoid bone grafting procedures. However, to our knowledge, no systematic review sought to determine which surgical indications would lead to better arcs of movement after surgery. With this, we seek to analyze the literature qualitatively and quantitatively to determine these indications.

MATERIALS AND METHODS

Search strategy in the literature

This systematic review was officially registered in PROSPERO on October 23, 2020 (CRD42020210462). This systematic review was conducted according to the guidelines of the International Preferred Reporting Items for Systematic Reviews and Meta-Analyses (PRISMA).

Electronic searches were performed using the Cochrane Library, PubMed, EMBASE, and LILACS databases in October 2022. Data from these databases were searched following the recommendations of Cochrane Collaboration, PRISMA, and Meta-analysis of Observational Studies in Epidemiology. To achieve maximum sensitivity in the search strategy, the terms "Latarjet" OR "Bristow" OR "Eden-Hybinette" OR "Bone block procedures" AND "Shoulder instability" were combined as keywords or MeSH terms. The reference list of all articles was reviewed for further identification of potentially relevant studies. The studies were evaluated using inclusion and exclusion criteria. There was no time limit on publications. There was no restriction regarding the language of publication. (Appendix 1)

Selection criteria

Inclusion criteria were as follows: (1) randomized controlled trials (glenoid bone graft surgery vs. anatomical surgery or glenoid bone graft surgery vs glenoid bone graft surgery; (2) prospective cohort studies in which glenoid bone graft surgery was evaluated. The exclusion criteria were as follows: (1) retrospective studies, (2) case reports (less than five cases), and (3) studies in which the inclusion criteria of patients did not consider radiological criteria, radiological criteria associated with clinical criteria, or arthroscopic criteria.

Data extraction and analysis

Relevant information regarding the characteristics of the studies, evaluation of the methodological quality of the studies, measurements of the ranges of motion, and follow-up time were collected independently by two authors using a standard form. The Downs and Black[13] checklist and the Cochrane risk of bias tool for randomized trials[14-17] were used to assess the quality of cohort studies and randomized controlled trials, respectively. The Downs and Black checklist[13] ranges from 0-28 points, with a score of 26-28 considered excellent, 20-25 good, 15-19 regular, and lower than 15 bad. Interobserver agreement (3 authors) was evaluated using the kappa test.

The studies were subdivided according to the main criterion used to indicate glenoid bone graft surgery:

- Radiological indication group (R) (10-25% anterior glenoid wear and/or off-track injuries)
- Radiological indication group associated with clinical indication (R + C) (same indications as radiological indication group + contact sports and/or ISIS (instability severity index score)) ≥ 4
- Arthroscopic indication group (A) (Hill-Sachs lesion with engagement)

The outcomes extracted and evaluated were: ranges of shoulder motion (elevation, loss of elevation, abduction, loss of abduction, lateral rotation in adduction, loss of lateral rotation in adduction, lateral rotation in abduction, loss of lateral rotation in abduction, medial rotation in abduction, loss of medial rotation in abduction, medial rotation in adduction, and loss of medial rotation in adduction).

Statistical analysis

The significance level was set at 0.05 (5%). A complete descriptive analysis of the quantitative data was performed using mean, median, standard deviation, coefficient of variation, and confidence interval. The Z test was used to compare the groups in the evaluated parameters. Due to the qualitative characteristics of this systematic review, it was not possible to perform a meta-analysis. The agreement between the three authors for the Downs & Black checklist was measured using Fleiss' kappa test for simultaneous analysis and Cohen's kappa test for paired analysis.

RESULTS

Search results and quality of studies

In the electronic search conducted in October 2022, 1567 articles were identified. After applying the inclusion criteria, 43 articles were selected and 29 articles were excluded (14 due to the association of surgical techniques, four due to the use of non-standardized inclusion criteria, 10 due to the absence of evaluation of the range of motion, and one due to the use of the same patients from another study already included). With this, a total of 14 articles were selected for the systematic review, which included 12 prospective cohort studies[12,18-27] and two randomized controlled trials.[28,29] A flow diagram based on PRISMA is shown in Figure 1. In addition, the characteristics of the included studies and their methodological quality are presented in Table 1.

Of the 12 included prospective cohort studies that were evaluated by the Downs & Black checklist,[13] seven (58.33%) were classified as weak, three (25%) as regular, and two (16.66%) as good. Regarding the agreement between authors, the Fleiss kappa test of the three authors showed a value of 0.842, which was classified as excellent. Appendix 3 shows the full results.

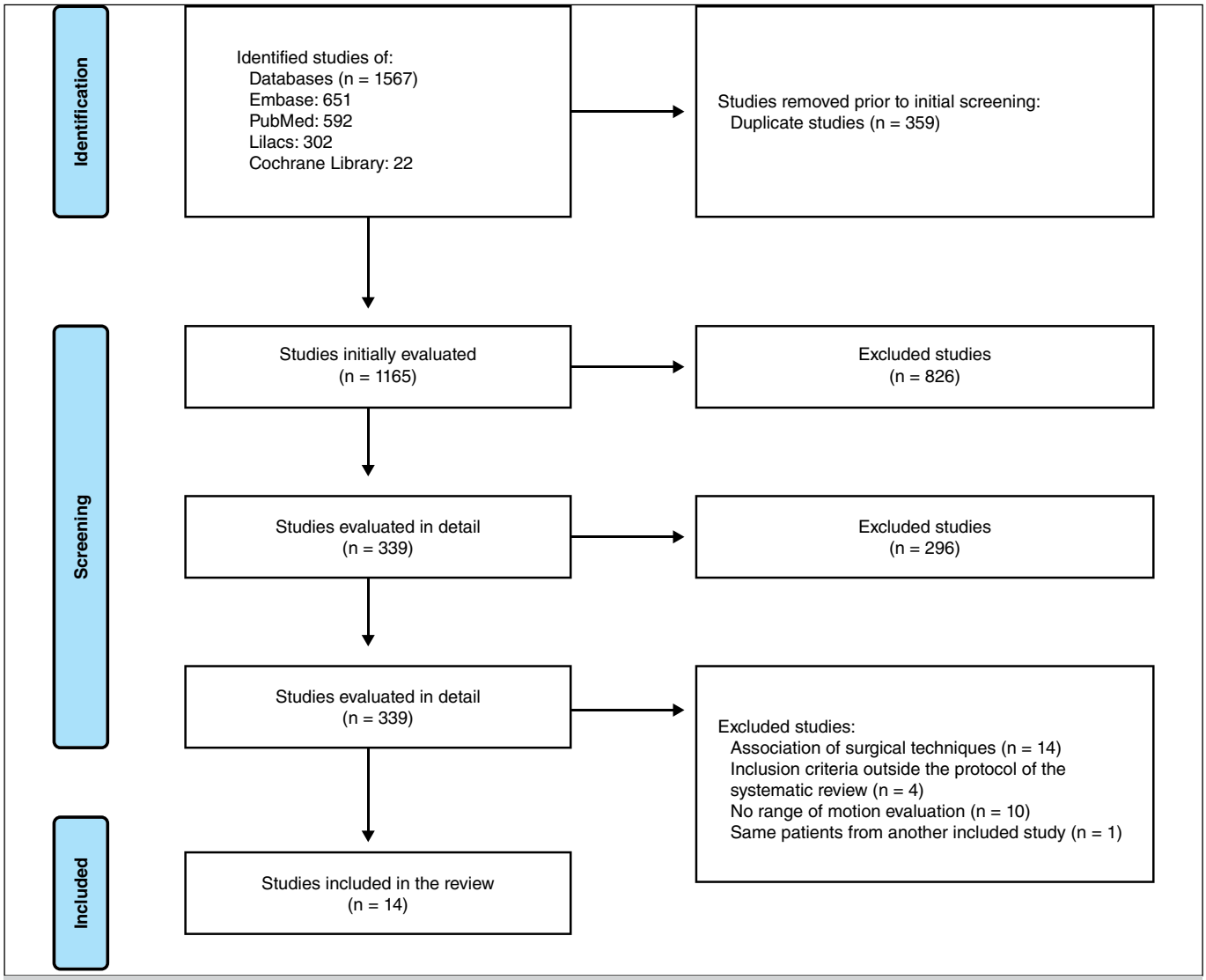

Figure 1. Flowchart based on the *International Preferred Reporting Items for Systematic Reviews and Meta-Analyses* (PRISMA).

Demographic data

In the total of the studies, 659 shoulders were included, of which 548 (83.15%) were of men, 69 (10.47%) of women and 42 (6.37%) had no defined gender in the study. The mean follow-up was 43.01 months (23.7-90.0 months). It was not possible to calculate the mean age, since this type of data was not provided in all studies.

Indications

Four studies included[20,21,27,28] used only radiological criteria and contained a total of 206 shoulders. Five studies included[18,19,24,25,29] used clinical and radiological criteria, with 245 shoulders. Four studies included[12,22,23,25] used arthroscopic criteria, with a total of 208 shoulders.

Surgical techniques

Different surgical techniques were described in the articles selected for this systematic review and were performed according to the surgeons' preferences and experiences. The techniques were used in the following frequencies: open Latarjet in 411 (66.91%) shoulders; arthroscopic Latarjet in 123 (18.66%) shoulders; open distal tibia graft in 50 (7.58%) shoulders; open Eden–Hybinette in 46 (6.98%) shoulders; and open Bristow in 29 (4.40%) shoulders.

Ranges of motion

The outcomes extracted and evaluated were: ranges of shoulder motion (elevation, loss of elevation, abduction, loss of abduction, lateral rotation in adduction, loss of lateral rotation in adduction, lateral rotation in abduction, loss of lateral rotation in abduction, medial rotation in abduction, loss of medial rotation in abduction, medial rotation in adduction, and loss of medial rotation in adduction).

Elevation was assessed in nine studies.[12,21-27,29] Elevation loss was evaluated in three studies.[19,20,30] Abduction was evaluated in two studies.[24,25] Abduction loss was evaluated in two studies.[19,20] Lateral rotation in adduction was evaluated in nine studies.[12,18,21-23,25-27,29] Loss of lateral rotation in adduction was evaluated in four studies.[20,22,28,30] Lateral rotation in abduction was evaluated in three studies.[21,22,26] Loss of lateral rotation in abduction was evaluated in four studies.[19,20,22,30] Medial rotation in abduction was evaluated in three studies.[21,25,26] Loss of medial rotation in abduction was evaluated in one study.[19] Medial rotation in adduction was evaluated in one study.[27] Loss of medial rotation in adduction was evaluated in four studies.[20,23,27,30]

Table 1. Characteristics of studies.

Author	Type of study	Shoulders (n)	Surgical technique	Surgical indications	Range of motion	Quality of studies	Follow-up (months)
Abdelhady et al 2015[18]	Prospective cohort	13 (10 men/3 women)	Latarjet open	1) Hill-Sachs < 20% humeral head diameter; 2) Ligament hyperlaxity	1) Lateral rotation in adduction	Weak	33.64
Abouelsoud and Abdelrahman 2015[28]	Randomized controlled trial	32 (no gender was mentioned)	Latarjet open (16) x Remplissage (16)	1) 3 episodes of dislocation in 12 months of conservative treatment; 2) Hill-Sachs 20-30% of the size of the humeral head on NMR	1) Loss of lateral rotation in adduction	Appendix 2	31.31
Ali et al. 2020[19]	Prospective cohort	48 (open Latarjet: 12 Men/3 women; arthrsoscopic Latarjet: 29 men/4 women)	Open Latarjet (15) x Arthroscopic Latarjet (33)	1) > 18 years old; 2) Osteochondral glenoid defect > 13.5%; 3) ISIS > 3 combined to seizure in the intermediate range of motion	Loss of: 1) Elevation; 2) Abduction; 3) Lateral rotation in abduction; 4) Medial rotation in abduction	Weak	30.5
Auffarth et al. 2008[20]	Prospective cohort	46 (40 men/6 women)	Open Eden-Hybinette	1) Glenoid defect > 5mm in length on AP and axial radiographs	Loss of: 1) Elevation; 2) Abduction; 3) Lateral rotation in adduction; 4) Lateral rotation in abduction	Weak	90
Belangero et al. 2021[29]	Randomized controlled trial	41 (37 men/4 women)	Open Latarjet (22) x Open Bristow (19)	1) Competitive sport 2) 10-20% anterior glenoid wear (CT)	1) Elevation; 2) Lateral rotation in adduction	Appendix 2	60
Burkhart et al. 2007[12]	Prospective cohort	47 (46 men/1 woman)	Open Latarjet	1) Inverted pear glenoid; 2) Hill-Sachs with engaging	1) Elevation; 2) Lateral rotation in adduction	Weak	52
Cautiero et al. 2017[30]	Prospective cohort	26 (does not mention genders)	Open Latarjet	1) Glenoid bone loss > 15% (CT - PICO method); 2) Hill-Sachs > 1/3 humeral head diameter; 3) Competitive sport of contact or above the head; 4) HAGL injury; 5) Very thin capsular tissue	Loss of: 1) Elevation; 2) Lateral rotation in adduction; 3) Medial rotation in adduction	Weak	53
Frank et al. 2018[21]	Prospective cohort	100 (96 men/4 women)	Open Latarjet (50) x Open tibia allograft (50)	1) Glenoid bone loss > 15%; 2) Tibia allograft preference: glenoid bone loss > 25%; important cartilaginous component	1) Elevation; 2) Medial rotation in abduction; 3) Lateral rotation in abduction; 4) Extension; 5) Abduction	Regular	45
Kordasiewicz et al 2016[22]	Prospective cohort	48 (46 men/2 women)	Open Latarjet (48) x Arthroscopic Latarjet (62)	1) Hill-Sachs engaging injury	1) Elevation; 2) Abduction; 3) Lateral rotation in adduction; 4) Lateral rotation in abduction	Regular	54.2
Kordasiewicz et al. 2019[23]	Prospective cohort	90 (80 men/10 women)	Latarjet Arthroscopic	1) Hill-Sachs engaging injury	1) Elevation; 2) Abduction; 3) Lateral rotation in adduction; 4) Lateral rotation in abduction	Regular	23.7
Moroder et al. 2018[24]	Prospective cohort	25 (13 men/12 women)	Open Latarjet (15) x Open Bristow (10)	1) > 40 years old; 2) Glenoid defect associated with clinically compensated cuff injuries	1) Elevation; 2) Abduction;	Weak	29
Vadalà et al. 2017[25]	Prospective cohort	24 (22 men/2 women)	Open Latarjet	1) ISIS > 6; 2) Participation in sports	1) Elevation; 2) Abduction; 3) Lateral rotation in adduction; 4) Lateral rotation in abduction	Weak	24
Yang et al. 2018[26]	Prospective cohort	91 (86 men/5 women)	Open Latarjet	Hill-Sachs injury with engagement	1) Elevation; 2) Lateral rotation in adduction; 3) Lateral rotation in abduction; 4) Medial rotation in abduction	Good	38.4
Zhu et al. 2017[27]	Prospective cohort	44 (32 men/12 women)	Open Latarjet	1) Glenoid bone loss > 20%	1) Elevation; 2) Lateral rotation in adduction; 3) Medial rotation in adduction	Weak	37.4

NMR: nuclear magnetic resonance; CT: computed tomography.

Comparisons between the evaluated groups

Ranges of motion

The following parameters were evaluated

a) Elevation
This parameter was evaluated in all groups. The best results were found in Group A, with a statistically significant difference compared to the other groups.

b) Loss of elevation
This parameter was not evaluated in all groups, not allowing a comparison between them.

c) Abduction
This parameter was not evaluated in all groups, not allowing a comparison between them.

d) Loss of abduction
This parameter was not evaluated in all groups, not allowing a comparison between them.

e) Lateral rotation in adduction (LR 1)
This parameter was evaluated in all groups. The best results were found in groups R and R + C, with a statistically significant difference compared to Group A. Complete results can be seen in Table 2.

f) Loss of lateral rotation in adduction (LLR 1)
This parameter was evaluated in all groups. Groups R and A presented better results, with statistical significance ($p < 0.001$). Complete results can be seen in Table 2.

g) Lateral rotation in abduction (LR 2)
This parameter was evaluated in all groups. Group R presented better results, with statistical significance compared to the other groups. Complete results can be seen in Table 2.

h) Loss of lateral rotation in abduction
This parameter was not evaluated in all groups, not allowing a comparison between them.

i) Medial rotation in abduction
This parameter was evaluated in all groups. The best results were found in Group R + C, with a statistically significant difference compared to the other groups ($p < 0.001$).

j) Loss of medial rotation in abduction
This parameter was not evaluated in all groups, not allowing a comparison between them.

k) Medial rotation in adduction
This parameter was not evaluated in all groups, not allowing a comparison between them.

l) Loss of medial rotation in adduction
This parameter was not evaluated in all groups, not allowing a comparison between them.

Briefly, there were the following results of the groups regarding the ranges of motion that are shown in Chart 1.

Table 2. Ranges of motion involving lateral rotation.

		Mean	SD	N
LR 1 Group R + C Group A	Group R	68.9	13	190
	68.4	7	79	
	53.7	17.3	275	
		Grp R	**Grp R + C**	
LR1	Grp R + C	0.654		
	Grp A	< 0.001	< 0.001	

		Mean	SD	N
LLR 1 Group R + C Group A	Group R	7.1	3	62
	13	5	26	
	7	5	47	
		Grp R	**Grp R + C**	
LLR1	Grp R + C	< 0.001		
	Grp A	0.903	< 0.001	

		Mean	SD	N
LR 2 Group R + C Group A	Group R	82	12.4	100
	62.9	13	79	
	66.7	16.4	138	
		Grp R	**Grp R + C**	
LR2	Grp R + C	< 0.001		
	Grp A	< 0.001	< 0.001	

LR 1: lateral rotation in adduction; LLR 1: loss of lateral rotation in adduction; LR 2: lateral rotation in abduction.

Chart 1. Summary of results regarding ranges of motion.

	Statistically positive results	Statistically negative results
Elevation	Group A	Group R Group R + C
Lateral rotation in adduction	Group R Group R + C	Group A
Lateral rotation in abduction	Group R	Group R + C Group A
Loss of lateral rotation in adduction	Group R Group A	Group R + C
Medial rotation in abduction	Group A	Group R Group R + C

DISCUSSION

In this systematic review, 23 studies were included, totaling 659 shoulders. Only prospective studies in which the indications for the choice of glenoid bone graft surgery were explicitly described were chosen to avoid the selection bias that can occur in retrospective studies. However, the analysis of the included studies showed a low methodological quality. Thus, the indications for the choice of glenoid bone graft surgery are very variable in the literature and are controversial. This systematic review aimed to determine which surgical indications would lead to better results regarding ranges of motion. For this, we divided the indications into three groups: radiological, clinical and radiological, and arthroscopic indications. Among the subgroups of indications included in this systematic review, the largest number of shoulders that underwent the glenoid bone grafting procedure was in the group of radiological and clinical indications (245 shoulders). In general, variable results were observed, with no group presenting better results for all variables studied.
In the radiological indications group (Group R), the indications were: 10-25% anterior glenoid wear and/or off-track injury. According

to Burkhart and De Beer[6], glenoid bone loss is a significant risk factor for recurrence of instability after Bankart repair. Initially, it was believed that the critical amount of glenoid bone loss was 25%.[6,31] Nevertheless, a recent cadaver study suggested that a 20% loss decreases shoulder stability after Bankart repair.[32] Yamamoto et al.[33] conducted a study to evaluate what would be the subcritical bone loss of the glenoid and found a value between 17-25%.

As described by Di Giacomo, Itoi, and Burkhart,[34] it is important to assess both glenoid and humeral bone loss and the relationship between them, as well as glenoid track measurements. Recent biomechanical studies on bipolar bone loss and the glenoid track concept have revealed a significant decrease in shoulder stability, with glenoid defects as small as 10-15%.[35]

In Group R + C, studies were included in which the indications were the same as in Group R, associated with the practice of contact sports and/or ISIS ≥ 4. The score takes into account clinical and radiological criteria. Initially, a score from 6 indicated glenoid bone graft surgery; in scores above this value, a failure rate of 70% was reported in cases where anatomical repair was chosen.[36] It is worth noting that this score uses radiographs for indication, and in our study, only three studies used radiographs to decide which surgery to perform. Currently, the glenoid track instability management score (GTIMS)[37] was created, incorporating the concept of glenoid track to ISIS and using only tomography as radiological parameter and not radiographs. Patients with on-track lesions score 0 and off-track score 4 points. The other parameters are equal to ISIS and a score from 4 points indicates glenoid bone graft surgery. It is important to emphasize that in the GTMIS the presence of an off-track lesion already leads to a score of 4 points, indicating glenoid bone graft surgery, without the need for evaluation of other parameters.

In Group A, the main indication was the presence of a Hill-Sachs lesion with engagement in the arthroscopic evaluation. We consider this mode of indication valid because it allows the evaluation of associated lesions, but with the anesthetized patient there may be an overindication of the glenoid bone grafting procedure because the patient is more relaxed by anesthesia. Due to this fact, we believe that the indication of glenoid bone graft surgery should be made in advance based on radiological and clinical data. This group of patients presented variable results in the parameters evaluated; however, it presented, along with the group with radiological indications, the highest number of statistically positive results. One hypothesis for these findings is of an overindication, leading to patients who did not need glenoid bone graft surgery being subjected to this type of surgery.

Concerning ranges of motion, Group A had the highest amount of statistically positive results along with Group R. Group A showed positive results in the parameters elevation, loss of lateral rotation in adduction, and medial rotation in abduction. Group R showed positive results in the parameters lateral rotation in adduction and loss of lateral rotation in adduction. On the other hand, Group R + C group was the one that presented the greatest number of statistically negative results, in the following parameters: elevation, lateral rotation in abduction, loss of lateral rotation in adduction, and medial rotation in abduction.

Previous studies that evaluated ranges of shoulder motion after glenoid bone graft surgery demonstrated favorable results, with the vast majority of patients presenting ranges of motion similar to preoperative levels.[11] Lateral rotation is the main movement that presents alteration in the postoperative period of this type of surgery.[38-40]

Many patients have loss of lateral rotation after the Latarjet procedure.[38-40] Hovelius et al.[38] found an average loss of lateral rotation in adduction of 7.4 degrees and in abduction of 8 degrees. They discussed that this could be avoided with proper rehabilitation.

The Latarjet procedure is associated with loss of active range of motion, loss of active lateral rotation up to 19 degrees[40], and minimal loss of active medial rotation.[41]

Ernstbrunner et al.[40] conducted a study in which they followed patients undergoing the Latarjet procedure as primary surgery for shoulder instability, and in the mean follow-up of 8.4 years there was only a loss of 4 degrees of lateral rotation compared to the contralateral side. Lafosse and Boyle[42] reported a loss of 18 degrees of lateral rotation and Sinha et al.[39] reported a loss of lateral rotation of 10 degrees and medial rotation of 6 degrees.

It is worth mentioning that for most sports this lateral rotation deficit does not bring repercussions, but for pitching patients it can mean loss of performance and termination of the sports career. Thus, in this group of patients, the glenoid bone graft surgery should be chosen carefully.

An important aspect to be observed is that, although Group A presented statistically positive results in the evaluated parameters regarding lateral rotation, both in adduction and abduction, this group presented statistically negative results. Group R had the best results concerning lateral rotation, presenting statistically positive results regarding lateral rotation in adduction, lateral rotation in abduction, and loss of lateral rotation in adduction. Our hypothesis was that Group R + C group would present the best results regarding ranges of motion, but this did not occur. We believed that, by using clinical and radiological criteria, there would be a better selection of patients, but groups A and R presented more favorable results. The clinical criteria used may have little influence or are not the most relevant for surgical indication.

In previous studies, glenoid bone graft surgery showed good functional results, despite a relatively high rate of complications.[11] The aim of our study was to determine which surgical indications are related to a better result regarding ranges of motion, since this surgery is often indicated in young patients and athletes, in whom the expectation of surgery is high. Our study seeks to help by suggesting the best forms of indication so that the best possible functional result is achievable.

The overall methodological quality of the studies was low. This is a factor that influenced the results of this systematic review. By the Downs & Black checklist[13] score, seven studies were classified as weak, three as regular, and two as good.

Limitations of this systematic review: the parameters evaluated in the studies and types of surgeries were considerably variable. The techniques used by the surgeons in the studies and the indications in each subgroup were not the same in the selected studies. The other limitations of the study are inherent to those of systematic reviews. The overall sample of patients included patients of different ages, functional demands, numbers of dislocation episodes, time to surgery, making it challenging to apply the results to a particular patient. Nonetheless, our systematic review is the first to attempt to determine which surgical indications would lead to a better outcome regarding ranges of motion.

CONCLUSION

In this systematic review, the subgroups presented variable results in the evaluated parameters; however, the groups of arthroscopic and radiological indications presented the highest amount of positive results, and the latter group presented the best results regarding lateral rotation.

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BONE RECONSTRUCTION IN THE TREATMENT OF TIBIAL HEMIMELIA: AN ALTERNATIVE TO AMPUTATION?

RECONSTRUÇÃO ÓSSEA NO TRATAMENTO DA HEMIMELIA TIBIAL: UMA ALTERNATIVA PARA AMPUTAÇÃO?

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ABSTRACT

Objective: To evaluate the advantages and disadvantages of bone reconstruction and lengthening compared to amputation in the treatment of tibial hemimelia for patients and their families. Methods: Systematic review of articles published in English and Portuguese between 1982 and 2022 in the MEDLINE, PubMed, Cochrane and SciELO databases. The variables of interest were: year of publication, sample characteristics, classification of tibial hemimelia according to Jones, treatment outcome and follow-up time. Results: A total of eleven articles were included in the scope of this review. The studies involved 131 patients, 53.4% male and 46.6% female. The age of the patients who underwent a surgical procedure ranged from 1 year and 10 months to 15 years. The most common type was Jones' I (40.9%). The most recurrent complications in the reconstruction treatment were: infection of the external fixator path, flexion contracture (mainly of the knee), reduction in the range of motion of the knee and ankle. Conclusion: We did not find enough relevant studies in the literature to prove the superiority of reconstruction. Amputation remains the gold standard treatment for tibial hemimelia to this day. ***Level of Evidence III, systematic review of level III studies***

Keywords: Tibial Hemimelia. Reconstruction. Amputation. Outcomes.

RESUMO

Objetivo: Avaliar as vantagens e desvantagens da reconstrução óssea e alongamento comparada à amputação no tratamento da hemimelia tibial para pacientes e familiares. Métodos: Revisão sistemática, com análise de artigos publicados nas línguas inglesa e portuguesa entre 1982 e 2022, nas bases de dados MEDLINE, PubMed, Cochrane e SciELO. As variáveis de interesse foram: ano de publicação, característica da amostra, classificação da hemimelia tibial segundo Jones, desfecho do tratamento e tempo de seguimento. Resultados: Fizeram parte do escopo desta revisão onze artigos. Os estudos envolveram 131 pacientes, 53,4% do sexo masculino e 46,6% do feminino. A idade dos pacientes submetidos a algum procedimento cirúrgico variou de 1 ano e 10 meses a 15 anos. O tipo mais comum foi o I de Jones (40,9%). As complicações mais recorrentes no tratamento pela reconstrução foram: infecção do trajeto de pinos do fixador externo, contratura em flexão (principalmente do joelho), redução do arco de movimento de joelho e tornozelo. Conclusão: Não encontramos na literatura estudos suficientemente relevantes para comprovar a superioridade da reconstrução. A amputação se mantém até os dias de hoje o tratamento padrão-ouro para hemimelia tibial. ***Nível de evidência III; revisão sistemática de estudos de nível III.***

Descritores: *Tibia Hemimelial. Reconstrução. Amputação. Medidas de Desfecho.*

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INTRODUCTION

Tibial hemimelia is a rare deformity of the lower limbs affecting one in every 1,000,000 live births.[1] It ranges from hypoplasia of the tibia to its total absence. The fibula is usually present, and may be dysplastic.[1] This disease occurs unilaterally or bilaterally, with an estimated 30% bilaterality, associated with syndromes or other deformities.[2]

Clinically, the individual may have a flexed or unstable knee, with absence of central and peripheral ligaments, fixed equinus varus deformity of the foot, polydactyly and medial ray deficiency. The spectrum of presentation of this pathology is much broader when compared to fibular hemimelia.[2]

Several associated deformities in the upper limbs are also found, such as: radius dysplasia, lobster claw deformity, syndactyly, triphalangism.[3] To date, in the literature, there is no specific genetic mutation identified as a cause of this pathology.[4]

All authors declare no potential conflict of interest related to this article.

The study was conducted at Hospital Estadual de Urgencias Governador Otavio Lage de Siqueira.
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In 1978, Jones, Barnes and Lloyd-Roberts[5] proposed a classification for tibial hemimelia which is still the most currently widely used. It divides the disability into four main groups, based on radiographs and skeletal morphology. Type 1 (a, b) consists of an absent tibia with or without a normal femoral epiphysis. Type 2 consists of an intact fibula with the presence of a proximal tibia and an absent distal tibial segment. Type 3 is a rare variety with an intact fibula and absent proximal tibia, and present distal tibial. Type 4 is distal tibiofibular diastasis.[6]

The treatment of this comorbidity remains controversial. The initial literature proposed amputation and possible prosthetization as the treatment method of choice for the most severe types, Jones' 1A and 1B. Studies supporting this option showed satisfactory results, especially if performed early.[7]

As medical propaedeutics advanced, orthopedic surgeons have been increasingly trying to use procedures that preserve the limb and its functionality. In 1965, Brown[8] described a technique based on centralizing the fibula below the femur with the aim of "tibializing" the used bone. Due to the multiple flexion contractures and limb discrepancy, the bone reconstruction was associated with lengthening by using external fixators, mainly according to the Ilizarov technique. Correction is then carried out gradually, with tissue distraction and adequate functionality of the lower limb joints involved. In 2016, Paley[3] modified the technique. Despite its growing use, its benefits and success are still uncertain, especially in terms of remaining contractures, prolonged treatment time and associated complications. As a result, there is still no suitable protocol for the surgical treatment of tibial hemimelia.

The aim of this study was to determine, through a systematic review, the advantages and disadvantages of bone reconstruction and lengthening for patients and their families compared to amputation, which is considered the gold standard in the treatment of tibial hemimelia.

MATERIALS AND METHODS

The formulation of the question and search strategy of the article were based on the PICO model (Population, Intervention Comparison, Outcome), widely used in evidence-based practice methodology and recommended for the construction of systematic reviews. The PRISMA model was used as a reference for the article selection flowchart.[9]

Search strategy

Articles published from 1980 to 2022 in English and Portuguese describing the treatment of tibial hemimelia and its outcomes, whether amputation or reconstruction were searched in the following databases: MEDLINE, PUBMED, COCHRANE and SCIELO. The initial search used the descriptors hemimelia combined with tibia, lower extremity deformities, and congenital.

Articles were selected by two independent examiners on the basis of reading the title and abstract. Potentially eligible articles were read in full. The examiners then checked the reference lists of all eligible articles attempting to find new references for this review.

Elegibility criteria

The inclusion criteria were: (1) population (adults or children); (2) intervention (bone reconstruction and lengthening or amputation); (3) outcome (functionality, quality of life); (4) articles published in the last 42 years – in English and Portuguese; (5) reviews with meta-analysis, clinical trials, cohort studies, case series, clinical cases; (6) studies with full text available in the searched databases.

Data extraction

After carrying out the previous steps, a reviewer proceeded to extract the following data from each article: year of publication, sample characteristics (sample size, population, age, gender), classification of tibial hemimelia treated according to Jones, outcome of the applied treatment and follow-up time.

The variables of interest were transferred by one of the authors to an Excel spreadsheet (Microsoft Corp., United States). The data of interest was treated using descriptive statistics. Due to the great heterogeneity of the studies, it was not possible to conduct a meta-analysis.

RESULTS

Based on the used descriptors and the date of publication indicated by the authors, a total of: 90 articles, 17 from PUBMED, 71 from MEDLINE, 2 from SCIELO and none from Cochrane were found.

Considering the eligibility criteria, 70 articles were excluded after reading the title and abstract. Among the most common reasons for exclusion were: studies that did not involve treatment, studies on genetic factors of the disease, concept studies, studies that did not include the outcome of the treatment applied. Articles that did not have full text available were also excluded. The 20 selected studies were checked for duplication, which found no identical articles. Subsequently, these articles were read in full and nine of them were excluded because they did not present relevant data for the review. After the selection stages and application of eligibility criteria, 11 articles were included in this systematic review. The PRISMA model flowchart was used to illustrate the process (Figure 1).

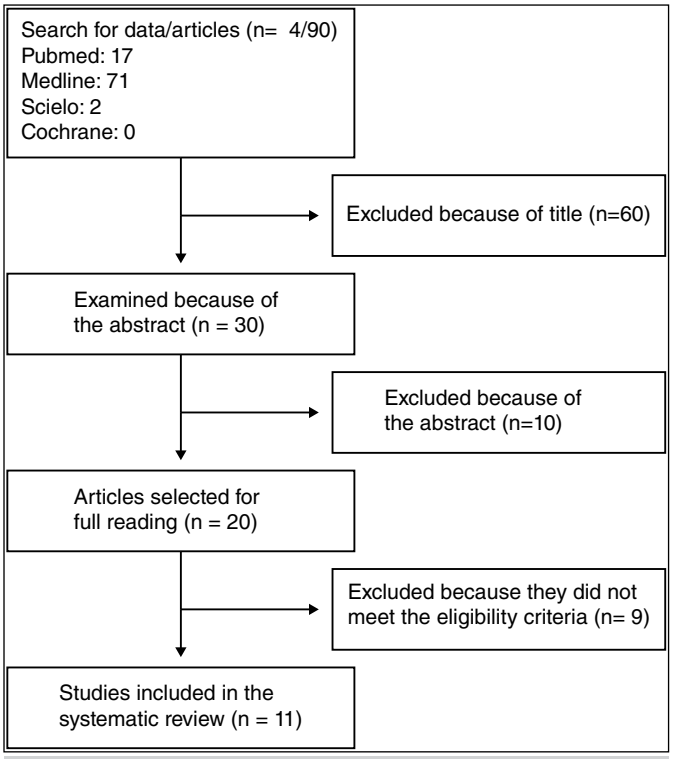

Figure 1. Fluxogram.

Next, the extracted data was summarized in a table for better visualization with the following variables: year of publication, type of study, sample size and characteristics, classification of tibial hemimelia, patient follow-up time and outcome of the used treatment (Table 1).

Table 1. Analysis of the studies included in the systematic review

Author/Yenr	Type of study	Sample size	Sex	Age	Classification	Follow-up time	Outcomes
Laufer et al. (2020)[1]	Retrospective case series study	10 patients (2 with bilaterality)	7 male; 3 female	Mean age: 2,3 years old	2 patients IV B (Paley); 4 patients VA; 6 patients VC	Average follow-up: 7.1 years	Mobility improved in all patients. All were able to walk with a full load and without pain, but all required knee-ankle-foot orthoses. All were able to participate in daily life normally. All relatives said that they had seen a great improvement compared to the preoperative situation and that they would opt for limb salvage treatment again. Despite the findings, the article concluded that amputation still has fewer complications and should be considered the gold standard.
Spiegel et al. (2003)[10]	Retrospective case series study	15 patients (4 with bilaterality)	10 male; 5 female	Mean age: 1 year and 10 months old	10 type I de Jones; 5 type II; 4 type III	Average follow-up: 7 years	All type I patients were treated with knee disarticulation without post-operative complications. Type II disabilities were treated with foot amputation (Syme or Chopart) and tibiofibular synostosis. No prosthetization problems were identified during follow-up. Type III cases were treated with Syme amputation, and two developed complications, including symptomatic instability in the proximal or distal joint. Regarding reconstructions, there are still no available guidelines to draw firm conclusions.
Balci et al. (2015)[11]	Retrospective case series study	21 patients (7 with bilaterality)	12 male; 9 female	Mean age: 4.8 years old	7 Jones type IA; 4 type 1B; 11 type II; 1 type III; 5 type IV	Average follow-up: 5.8 years old	All the disarticulated knees (6) were Jones type IA. One patient with type III underwent transtibial amputation. In the other patients, Brown's method associated with an external fixator was used. There were 14 complications: 3 flexion contractures > 30 in the knee joint, 2 equinus deformities, 3 knee dislocations, 2 knee subluxations and 4 plastic deformities. In Jones type IA cases the SF36 questionnaire was much higher in those who underwent disarticulation than those who underwent reconstruction. The study showed that disarticulation was not superior to reconstruction, except in type IA patients.
Youssef Ahmed (2014)[12]	Retrospective case series study	8 patients	5 male; 3 female	Mean age: 2.3 years old	8 Jones type II	Average follow-up: 2.6 years	There were positive results in all eight cases, with a good range of motion in the knee and plantigrade foot, and all patients walked and had no pain. All cases showed total patient and parent satisfaction. The article stated that by comparing the results obtained from limb salvage with those of amputations and prosthetic replacements, in terms of functional outcome, duration of treatment, incidence of complications and the number of surgical procedures required, amputation would be much better.
Carraza-Bencano e González-Rodríguez (1999)[13]	Case report	1 patient	1 female	15 years old	Jones type II	Average follow-up: 2 years	The LC-monotube external fixator was used as a treatment to correct the 13.5 cm discrepancy, with the hindfoot in 60 varus, with the forefoot slightly in adduction and supination. At the end of the follow-up, the patient was walking without the aid of canes, with notable clinical and functional improvement. A plantigrade foot was obtained, with a stable ankle that did not require shoe modifications, allowing the patient to walk and run freely without limitations.
Fernandez-Palazzi, Bendahan e Rivas (1998)[14]	Retrospective case series study	18 patients (4 with bilaterality)	7 male; 11 female	Mean age: not mentioned	9 Jones type IA cases; 4 type IB; 3 type II; 4 type IV	Average follow-up: not mentioned	In 10 type Ia and Ib cases, knee disarticulation was performed. One type II case underwent below-knee amputation and proximal tibiofibular synostosis. Two type III cases were treated with Syme amputation. Only in the type IV deformity was reconstructed. The article concluded that amputation is the procedure with the lowest cost and best adaptation. The Brown procedure did not meet expectations.
Hosny (2005)[15]	Retrospective case series study	6 patients	3 male; 3 female	Mean age: 7.5 years old	2 Jones type IA; 4 type II	Average follow-up: 3 years	In type IA cases, Ilizarov was applied from the femur to the foot. The Brown procedure was performed one month later. Families were satisfied in all cases. Infection in the pin tract occurred in all cases, which were treated with oral antibiotics. Knee flexion deformity remained in two cases. Fracture of the femur occurred in one case. It was believed that the method of treating tibial hemimelia described in this series can be appreciated in cases in which amputation is refused, as marked functional improvement can be expected.

Table 1. Analysis of the studies included in the systematic review

Author/Yenr	Type of study	Sample size	Sex	Age	Classification	Follow-up time	Outcomes
Loder e Herring (1987)[16]	Retrospective case series study	6 patients (3 with bilaterality)	3 male; 3 female	Mean age: 9. 5 months old	Classification not mentioned	Average follow-up: from 1 year and 8 months to 10 years and 3 months	Five out of nine knees were considered to have a good result, with contracture in flexion < 10 degrees, and three achieved full extension. Subsequently, all nine subsequently developed increased flexion contractures. Only one knee maintained active quadriceps strength. Three developed varus and medial subluxation, and one underwent disarticulation. According to the Jakayakumar and Eilert criteria, no limb achieved satisfactory results.
Shrivastava et al. (2009)[17]	Case report	1 patient	1 male	Age: 9 years old	Not included in Jones' classification	Follow-up: 4 years	The total lengthening of the fibula achieved during reconstruction was 23 cm. The external fixator was applied for 635 days. The range of movement of the knee was 0-90 (active) and 0-110 (passive). The knee showed no signs of instability. At the end of the follow-up, the patient was able to walk without pain. There were no major complications. The article suggests that amputation can be avoided with proper planning and salvage surgery.
Courvoisier et al. (2009)[18]	Retrospective case series study	9 patients (1 with bilaterality)	5 male; 4 female	Mean age: 2 years and 1 month old	4 Jones type I; 5 type II	Average follow-up: 18.3 years	The Ilizarov method was used in five cases in combination with the Brown technique. One case evolved with knee disarticulation. One patient progressed to bilateral knee arthrodesis. The average maximum knee flexion was 35° (0°-90°) in type I deficiencies and 118° (90°-140°) in type II deficiencies. In two patients, knee stabilization was achieved at the end of the correction. Due to the associated anomalies often reported in type I congenital tibial deficiencies, amputation remained the treatment of choice.
Shahcheraghi e Javid (2016)[19]	Cohort study	36 patients (12 with bilaterality)	17 male; 19 female	Mean age: 12 years and 1 month old	14 Jones type I, 16 types II, no type III, 11 type IV. 7 of the cases were not classified in any Jones subtype.	Average follow-up: 9 years	Knee movement was normal for all except those with previous joint abnormalities. The ankle was quite stiff in 14 cases and 22 had around 15 degrees of range of motion. Quality of life was assessed using the PedsQL score, indicating 68 points in the reconstruction group and 64.6 in the amputee group. The reconstruction group obtained a better functional score than the amputee group in 4 items: physical, social, psychological and school. Among the amputee group, 4 were totally satisfied and 4 were partially satisfied. In the reconstruction group, 8 were totally satisfied, 19 were almost satisfied and 1 was dissatisfied.

The studies involved 131 patients, 53.4% of whom were male and 46.6% female. The age of the patients who underwent a surgical procedure ranged from 1 year and 10 months old to 15 years old, but most of them were treated as early as possible. Among the limbs operated on, the most common variant, according to Jones' classification, was type 1 (40.9%), followed by type 2, (40.1%). However, as a bias, there was one study that did not mention classification,[16] another that classified patients according to Paley's classification,[1] a case report[17] with a variant of presentation that could not be classified according to Jones and a study with seven patients that also did not fit into the types proposed by Jones.[19] Bilaterality was found in 33 patients (25.2% of cases), which is in line with literature information.[2]

Among the main complications found by the authors regarding the treatment anchored in reconstruction, we can mention: infection of the external fixator pin path, but all patients had satisfactory resolution after using oral antibiotics; maintenance or new flexion contracture, especially of the knee; reduction in the range of movement of the knee and ankle, and the need for multiple surgical procedures. These complications were not found in the group of patients who underwent amputation or disarticulation.

All articles used Brown's method, with centralization of the fibula on the femur, as one of the types of employed treatment. However, there was no homogeneity in deciding which type of classification would be used: disarticulation, amputation or salvage surgery, which constituted a bias to the comparative evaluation of the methods. Only one article[11] systematized treatment satisfaction using the SF36 instrument; the others assessed satisfaction and post-operative quality of life descriptively, with the main parameter being the individual's ability to walk without the aid of orthopedic supports. One article[19] used the PedsQL questionnaire to assess post-operative quality of life of patients who underwent amputation compared to those that underwent reconstruction.

DISCUSSION

The first reported case of tibial hemimelia was described in 1841, and by 1941 around 79 cases had been published. The diagnosis can be made in the uterus, from the 16th week of pregnancy, by ultrasound. Genetic inheritance varies, with cases of autosomal dominant and autosomal recessive transmission reported.[2]

The most widely used classification was proposed by Jones in 1978, which divides the form of presentation of tibial hemimelia into four main groups, the first group being subdivided into two others.[1,10] In 2003, Dror Paley proposed another classification, which was modified in 2015.[3] There are five main types and 11 subtypes. Type 1 is the hypoplastic but not deficient tibia,

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with increased growth of the fibula. Type 2 has a proximal and distal tibial epiphysis, but a dysplastic ankle. Type 3 presents distal tibiofibular diastasis and absence of the tibial pilon. Type 4 is marked by distal tibial aplasia with preservation of the proximal epiphysis. Finally, type 5 corresponds to complete tibial aplasia with the knee in flexion contracture.[3]

The importance of these classifications is mainly in terms of treatment and prognosis guided by the subtypes. Initially, treatment was based on amputation or disarticulation at the level of the knee, especially for Jones subtypes Ia and Ib.[12] However, this therapeutic proposal is not always welcomed in certain cultures. Kumar Sahoo et al.[20] published a cohort study of 24 patients with tibial deficiency in India in 2019. Of these, only one patient opted for amputation treatment, showing that in some countries such acceptance is still low.

Treatment based on bone reconstruction and lengthening was instituted for the affected joints, ankle and knee, with the aim of improving stability, function and aesthetics.[15] Among the treatments proposed and the studies used here, we can mention: for cases of complete absence of the tibia, centralization of the fibula over the femoral condyles with fusion or arthroplasty (initially described by Brown).[8] For cases of partial tibial deficiency, the following options are available: synostosis of the tibial remnant with the fibula, contralateral transposition of the fibula, fusion of the fibula with the talus, transfer of the fibula proximal to the femoral intercondylar notch and both proximal and distal synostosis of the tibia with the fibula.[3]

The choice of the best reconstruction method varies according to the patient's profile, the classification of the tibial hemimelia, the surgeon's experience and the quality of the quadriceps muscles, as well as the degree of flexion in the knee and ankle joints.

To date, we have found no studies in the literature with sufficient basis to guide the choice of treatment for each case of tibial hemimelia, whether amputation or reconstruction. The function of the quadriceps with knee extension seems to be mandatory in order to obtain satisfactory results when centralizing the fibula as a treatment. The objectives of the proposed and chosen treatment are: to keep the foot plantigrade, to keep the knee joint functional, to maintain stability of the ankle joint, most of the time using arthrodesis as an instrument, and to maintain adequate limb length quality.[11-13]

In 2015, Shahcheraghi and Javid,[19] presented a study with the largest sample of patients with tibial hemimelia undergoing some kind of treatment. Out of a total of 36 patients, 26 were treated with bone reconstruction and eight underwent an amputation procedure. This is one of the few studies comparing patient satisfaction and quality of life using a questionnaire. Quality of life was assessed using the PedsQL score, which showed 68 points in the reconstruction group and 64.6 in the amputee group. The reconstruction group obtained a better functional score than the amputee group in four items: physical, social, psychological and school. In terms of "satisfaction", the amputee group had four patients who were totally satisfied and four who were partially satisfied. In the reconstruction group, out of the 28 patients, eight were totally satisfied, 19 were almost satisfied and one was dissatisfied.

In 2015, Balci et al.[11] also presented results regarding the quality of life of patients treated with reconstruction compared to those who opted for amputation. The authors used the SF36 questionnaire and concluded that the results were much higher in patients who underwent amputation. The most common complications of the reconstruction procedures were: knee flexion contractures, knee instability, decreased range of motion of the knee and ankle and the need for multiple serial procedures, infection of the external fixator pin tract, as well as reoperations.

Fernandez-Palazzi, Bendahan and Rivas[14] performed disarticulation on all the patients they approached with tibial hemimelia classified as Jones type Ia and Ib, with the initial argument that Brown's procedure (centralization of the fibula) does not show adequate functional results for the limb. Another argument used by authors, who advocate amputation, is based on adaptation. The younger the patient undergoes the procedure, the faster their physiological accommodation and viability to prosthetization.

The choice of treatment that includes reconstruction and bone lengthening is still new and depends on the surgeon's experience. In 2021, Dror Paley published an article indicating his preference for reconstruction.[2] The procedure was performed on a sample of 250 patients. In addition to correcting the limb discrepancy, it also corrected equinus varus deformities of the foot. Treatment was gradually conducted, using an external fixator associated with internal synthesis, such as femoral osteotomy and patelloplasty if necessary. Despite describing the technique and presenting a large sample, the author did not evidence the complications related to the procedure.[2]

Despite the improvement in reconstructive surgery for the treatment of tibial hemimelia over the last decade, there is still not enough data in the literature on long-term results to help devise a treatment protocol, especially in cases of complete tibial agenesis.

CONCLUSION

The study had some limitations, such as the small sample of patients approached, non-standardization of groups of patients undergoing amputation or reconstruction according to Jones' classification, and the variety of long-term results and described complications. After extensive reading and according to the table presented, amputation is still the first choice of treatment, especially for Jones type Ia and Ib cases. This procedure saved patients from multiple approaches and, in most of the cases presented, still brought the best functional outcome and adaptation for them. Reconstruction is a complex, long-term treatment modality with a high rate of complications.

In conclusion, reconstruction surgery can be offered with the combination of osteogenic distraction principles in patients with tibial hemimelia. The patient and their family should be approached, and their treatment's expectations understood. Distraction osteogenesis treatment techniques and Ilizarov's principles should be applied by experienced surgeons in specialized centers.

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