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ABOUT COVER

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ORIGINAL ARTICLE

Prospective Study

Pain and function deteriorate in patients awaiting total joint arthroplasty that has been postponed due to the COVID-19 pandemic

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Abstract

BACKGROUND

Elective total joint arthroplasty (TJA) procedures have been postponed as part of the coronavirus disease 2019 (COVID-19) response to avert healthcare system collapse. Total hip arthroplasty (THA) and total knee arthroplasty (TKA) procedures comprise the highest volume of elective procedures performed at health care facilities worldwide.

AIM

To determine the demand for TJA despite the pandemic and the impact of surgery postponement on physical and mental health.

METHODS

We conducted a prospective cross-sectional telephonic interview-based study on patients awaiting THA and TKA at an academic institution in South Africa. The questionnaire consisted of four sections. The first section recorded baseline demographic data and medical co-morbidities, the length of time spent awaiting TJA, and the patients' desire to undergo elective surgery despite the COVID-19 pandemic. Section 2 and Section 3 assessed the patients' current physical and mental health, respectively, as a consequence of deferred surgical intervention. The last section established the patients' perception of the healthcare system's response to the COVID-19 pandemic and necessity to postpone elective surgery. Patients received counseling and education on the current state of surgery during

indirectly related to this study.

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the COVID-19 pandemic and associated risks. Thereafter, patients were once again asked about their desire to undergo TJA during the COVID-19 pandemic.

RESULTS

We included 185 patients (65.95% female; mean age: 50.28 years) awaiting TJA for a mean of 26.42 ± 30.1 mo. Overall, 88.65% of patients wanted TJA despite the COVID-19 pandemic. Patients awaiting TJA for 1-3 years were 3.3-fold more likely to want surgery than those waiting < 1 year ($P < 0.000$). Patients with comorbidities were 8.4-fold less likely to want TJA than those with no comorbidities ($P = 0.013$). After receiving education, the patients wanting TJA decreased to 54.05%. Patients who changed their opinion after education had less insight on the increased morbidity ($P = 0.046$) and mortality ($P = 0.001$) associated with COVID-19. Despite awaiting TJA for shorter period (24.7 ± 20.38 mo), patients who continued to demand TJA had greater pain ($P < 0.000$) and decreased function ($P = 0.043$) since TJA postponement.

CONCLUSION

There is deterioration in health for patients, who have had elective procedures postponed during the COVID-19 pandemic. Waiting lists should be prioritized for urgency with the re-initiation of elective surgery.

Key Words: Total hip arthroplasty; Total knee arthroplasty; Elective surgery; COVID-19; Waiting lists; Primary total joint arthroplasty

Core Tip: This was a prospective cross-sectional study of patients awaiting elective total joint arthroplasty (TJA) that was postponed during the coronavirus disease 2019 (COVID-19) pandemic. We investigated the demand for elective TJA, impact of surgery postponement on overall health, and the role of patient education regarding the healthcare system's response during the COVID-19 era. After receiving counseling about the peri-operative risks of COVID-19 infection, patients who continued to demand elective TJA had greater pain and decreased function compared to other patients, despite awaiting surgery for the shortest length of time. Waiting lists should be prioritized for urgency with the re-initiation of elective surgery.

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INTRODUCTION

The infectious disease caused by the novel severe acute respiratory syndrome coronavirus 2 virus (coronavirus disease 2019 [COVID-19]) was declared an international pandemic by the World Health Organization in March 2020[1-3]. In response, a moratorium was declared on the performance of elective surgery in many countries to avert healthcare system collapse, preserve equipment, and maintain resources and hospital capacity[4-8]. Approximately 28 million elective operations were cancelled or postponed worldwide during the peak 12 wk of this global pandemic[7,8]. Total hip arthroplasty (THA) and total knee arthroplasty (TKA) procedures comprise the highest volume of elective procedures performed at health care facilities worldwide[4,8]. A survey of the European Hip Society and the European Knee Associates from 40 different countries reported a near total shutdown of total joint arthroplasty (TJA) with 92.6% of primary TJA procedures being cancelled[7]. The demand for TJA is already high and waiting lists continue to rise with approximately 150000 elective procedures performed per month in the United States cancelled at some time due to the COVID-19 response[3,7,8]. The prolonged postponement of elective

TJA has had devastating economic implications on the healthcare system. It is estimated that the process of re-initiation of elective procedures following the COVID-19 pandemic in developing countries would result in an approximate loss of $700 billion[9].

In addition to the growing economic burden, patients awaiting surgery for more than 180 d have demonstrated increased risks for poor outcomes after TJA[10,11]. Patients with hip and knee osteoarthritis on extended waiting lists for surgery deteriorate with time on the pain and physical function on the Western Ontario McMasters Universities Osteoarthritis index scores and joint-specific Oxford scores[10,11]. Poor pre-operative baseline function is also associated with worse pain and functional outcomes up to 24 mo after TJA[10-12].

The aim of this study was to gain insight into patient perceptions in the setting of a waiting list for TJA at an academic institution in the COVID-19 era. Through a questionnaire-based telephone interview, we assessed patient demand for elective TJA and evaluated the impact of the postponement of TJA on function and mental health. Lastly, we assessed the effect of purposeful patient education and counseling about the reasoning behind postponement of elective surgery on patient demand for TJA[13].

MATERIALS AND METHODS

We conducted a prospective cross-sectional telephonic interview-based study of 227 patients awaiting TJA at a single, referral academic institution in Johannesburg, South Africa during the COVID-19. There were 118 patients and 109 patients planned for elective primary TKA and THA respectively, during this time who had their surgery postponed. Patients requiring emergency surgery for hip fractures, periprosthetic fractures, joint dislocation, or periprosthetic joint infections were excluded. Institutional review board ethics approval was obtained (M190528) before commencement of the study. Contact information was obtained for all patients from the institution's TJA waiting list. This waiting list generally operates on a first-in first-out basis with exceptions for cases that are deemed clinically urgent. The list has been used to capture data of patients who qualify for and consent to TJA. It is used to plan and prepare surgical lists and has been operational since 2004.

Interviews were conducted from 20 June to 10 July 2020, a full 6 wk after all elective surgery in both private and public hospitals in South Africa had been cancelled in response to the global COVID-19 pandemic as mandated by the South African Disaster Management Act. At the time of initiation of patient interviews, our institution had already made the decision to only revisit resumption of elective procedures after the 1st of October 2020, a period of 32 wk. Interviews were all conducted telephonically by two post-graduate orthopedic surgery students, and all interviews were recorded. The interviewers were fluent in all major South African language groups and all patients were, to the extent possible, interviewed in their first language. A single, standardized and structured questionnaire was used for all interviews, and all interviews were recorded. Patients were given the option to provide verbal voluntary consent or refusal to participate in the study after being informed of its purpose. The questionnaire consisted of four sections.

The first section recorded baseline demographic data including age, gender and medical co-morbidities including heart disease, diabetes mellitus and human immunodeficiency virus infection. The time that each patient had spent waiting for elective, primary TJA was calculated from the date the patient was first added to the waiting list until the date of suspension of all elective surgery lists, 20 March 2020. Lastly, we ascertained the patients desire to undergo elective TJA procedures despite the COVID-19 pandemic.

Section 2 assessed the patients current disease state as a consequence of the deferred surgical intervention. A 5-point Likert scale was used to determine the degree to which the patient felt the postponement of surgery had affected their pain, numerical rating scale (NRS) pain score, functionality and need for analgesia. Section 3 was an evaluation of mental health. Depressive symptoms including weight gain and loneliness were recorded. A 5-point Likert scale was used to evaluate the patients' anxiety regarding TJA during the COVID-19 pandemic.

Section 4 endeavored to establish the patients' perception of the healthcare system's response to the COVID-19 pandemic and necessity to postpone elective surgery. We assessed patients' knowledge of basic coronavirus transmission prevention measures such as the wearing of face masks, general hand hygiene, and social distancing. We attempted to assess the extent of insight that patients had regarding the response of

the healthcare system to the COVID-19 pandemic. This included the patient's knowledge of infection control procedures that have been implemented to minimize disease spread. Thereafter, patients were counseled regarding the current state of surgery during the COVID-19 pandemic. Patients were educated on the introduction of routine testing for COVID-19 prior to admission and preclusion of visitors during their hospital stay. Patients were then counseled with respect to poor clinical outcomes in COVID-19 infected patients undergoing surgery including the possibility of death and the risk of contracting COVID-19 as an inpatient. Upon conclusion of this patient education patients were once again asked about their desire to undergo TJA during the COVID-19 pandemic.

Results were tabulated with mean and standard deviation calculated for integer variables. Chi-squared testing was used to compare relationships between categorical variables. Patient age and period awaiting TJA were categorized and responses were compared across sub-groups. Additional categorical variables that responses were compared across included comorbidities and demand for TJA despite COVID-19 pandemic both before and after patient education and counseling. Odds ratios (ORs) were calculated using logistics regression for binary outcomes. Statistical significance was set at $P < 0.05$. The statistical software used for analysis was *R* 4.0.2 for Windows Copyright (C) 1989, 1991 Free Software Foundation, Inc with interface *R* Studio Version 1.3.959.

RESULTS

Sample population and demographic data

There were 185 patients (81.5%) included in the study (Figure 1). The mean age was 50.28 years (range: 33-69) with 122 female patients (65.95%). There were 106 (57.3%) patients awaiting surgery for TKA and 79 (42.7%) for THA, respectively. The overall mean length of time for patients awaiting TJA was 26.42 mo (standard deviation [SD]: 30.1; range: 3-264 mo). The mean length of time for patients awaiting THA was 28.29 mo (SD: 34.87; range: 3-264 mo) and TKA was 25.03 mo (SD: 26.07; range: 4-200 mo), respectively. There were 126 patients (68.11%) with one or more comorbidities. Additional demographic details and results for the questionnaire are depicted in Table 1.

Patient demand for TJA

There were 164 patients (88.65%) who wished to undergo TJA and 21 patients (11.35%) that did not want elective TJA, respectively at the earliest opportunity despite the COVID-19 pandemic. Patients awaiting TJA for more than 3 years were 4.3-fold more likely to want surgery compared to those awaiting surgery for less than 1 year (OR > 3 years 6.15; < 1 year 1.41; $P = 0.029$). Patients awaiting TJA between 1 and 3 years were 3.3-fold more likely to want surgery compared to those awaiting surgery for less than 1 year (OR: 1-3 years 4.71; < 1 year 1.41; $P < 0.000$). Patients with more than one comorbidity were 8.4-fold less likely to want elective surgery during the pandemic compared to those with no comorbid conditions (OR > 1 comorbidity 0.24; no comorbidities 3.38; $P = 0.013$).

Pain and function since the postponement of surgery

There was increased joint pain experienced by 101 patients (55.49%) since the postponement of their TJA. The responses for pain and function were compared between patients that wanted TJA despite the COVID-19 pandemic to those who did not want surgery at the earliest opportunity (Table 2). Increased joint pain was experienced by 58.28% ($n = 95$) of patients that wanted TJA despite the COVID-19 pandemic compared to 31.58% ($n = 6$) of patients that did not want elective surgery at the earliest opportunity ($P = 0.037$). The mean NRS pain score overall was 7.37 (SD: 2.24; range: 0-10).

There were 123 patients (67.21%) who felt their functionality due to joint pain had decreased since the postponement of surgery. There were 73 (78.5%) patients between the age of 45 to 60 years who had decreased functionality since the postponement of surgery compared to 25 (46.3%) and 24 (68.6%) patients under 45 years and over 60 years of age, respectively ($P = 0.015$). There was decreased function for patients that wanted TJA compared to those who did not, demonstrated by significant differences in decreased functionality due to joint pain (70.99% *vs* 38.1%; $P = 0.002$) and decreased walking distance (50.3% *vs* 28.58%; $P = 0.034$) respectively.

Table 1 Coronavirus disease 2019 arthroplasty waiting list questionnaire response results

Section I: Demographic data	
Age in yr, mean ± SD	50.28 ± 8.9
Gender, *n* (%)	
Male	63 (34.05)
Female	122 (65.95)
TJA, *n* (%)	
TKA	106 (57.3)
THA	79 (42.7)
Awaiting TJA in mo, mean ± SD	26.42 ± 30.1
Number of comorbidities, *n* (%)	
0	59 (31.89)
1	95 (51.35)
2	29 (15.68)
3	2 (1.08)
Comorbidities, *n* (%)	
DM	27 (14.59)
HPT	89 (48.11)
TB	5 (2.70)
Cardiac disease	9 (4.86)
Asthma	12 (6.49)
Lung disease	5 (2.70)
HIV	18 (9.73)
Demand for TJA despite COVID-19 pandemic, *n* (%)	
Yes	163 (88.11)
No	22 (11.89)
Section II: Pain and function	
Joint pain since postponement of TJA, *n* (%)	
Decreased	23 (12.64)
Same	58 (31.87)
Increased	101 (55.49)
Access to pain medication, *n* (%)	
Yes	90 (72)
No	35 (28)
NRS pain score, mean ± SD	7.37 ± 2.24
Current state in comparison to before TJA postponement	*n* (%)
Functionality due to joint pain	
Much less	24 (13.11)
Less	99 (54.1)
Same	50 (27.32)
More	5 (2.73)
Much more	5 (2.73)
Walking distance	

Much less	30 (16.3)
Less	59 (32.07)
Same	88 (47.83)
More	6 (3.26)
Much more	1 (0.54)
Sitting	
Much less	18 (9.89)
Less	57 (31.32)
Same	101 (55.49)
More	6 (3.3)
Much more	0 (0)
Sleep	
Much less	25 (13.59)
Less	25 (13.59)
Same	104 (56.52)
More	20 (10.87)
Much more	10 (5.43)
Need for pain medication	
Much less	8 (4.57)
Less	12 (6.86)
Same	74 (42.29)
More	47 (26.86)
Much more	34 (19.43)
Section III: Mental health	*n* (%)
Weight change since TJA postponement	
Lost	33 (25.98)
Same	56 (44.09)
Gained	38 (29.92)
Feelings of isolation or loneliness	
Yes	59 (32.78)
No	121 (67.22)
Anxiety to get infected with COVID-19	
No	28 (15.3)
Minimal	20 (10.93)
Neutral	22 (12.02)
Moderate	47 (25.68)
Severe	66 (36.07)
Anxiety to spread COVID-19 to relatives	
No	28 (15.64)
Minimal	17 (9.5)
Neutral	14 (7.82)
Moderate	39 (21.79)
Severe	81 (45.25)

Anxiety about Finances due to COVID-19	
No	18 (10)
Minimal	20 (11.11)
Neutral	82 (45.56)
Moderate	40 (22.22)
Severe	20 (11.11)
Section IV: Insight	
Understanding of healthcare system response to COVID-19	*n* (%)
Aware no elective surgery	
Yes	137 (74.05)
No	48 (25.95)
Fair no elective surgery	
Yes	157 (84.86)
No	28 (15.14)
Important to delay elective surgery	
Yes	162 (87.57)
No	23 (12.43)
Knowledge of preventative measures	*n* (%)
Hand washing	
Yes	124 (67.03)
No	62 (32.97)
Social distancing	
Yes	124 (67.03)
No	62 (32.97)
Wearing mask in public	
Yes	123 (66.49)
No	63 (33.51)
Peri-operative patient considerations for COVID-19	*n* (%)
Routine pre-operative screening	
Yes	122 (89.1)
No	15 (10.9)
Increased morbidity if COVID-19 positive	
Yes	120 (88.9)
No	15 (11.1)
No visitors allowed	
Yes	114 (87)
No	17 (13)
Increased mortality if COVID-19 positive	
Yes	92 (67.2)
No	45 (32.8)
Patient education and counselling	
Still demand TJA despite COVID-19 pandemic	*n* (%)
Yes	100 (54.05)

No	85 (45.95)

COVID-19: Coronavirus disease 2019; DM: Diabetes mellitus; HIV: Human immunodeficiency virus; HPT: Hypertension; NRS: Numerical rating scale; SD: Standard deviation; TB: Tuberculosis; THA: Total hip arthroplasty; TJA: Total joint arthroplasty; TKA: Total knee arthroplasty.

Mental health during the COVID-19 pandemic

There were 113 patients (61.75%), who experienced increased anxiety about getting infected with COVID-19 should they get their elective TJA during this time. There were 120 patients (67.04%) who experienced increased anxiety about subsequently spreading COVID-19 to relatives. The responses for mental health were compared between patients that wanted TJA despite the COVID-19 pandemic to those who did not want surgery at the earliest opportunity (Table 3). The increased anxiety of getting infected with COVID-19 was found in 64.19% (n = 104) of patients who wanted TJA compared to 42.86% (n = 9) of patients that did not want surgery at the earliest opportunity (P = 0.013). Similarly, there was increased anxiety to spread COVID-19 to relatives for 110 patients (69.62%) that wanted TJA and 10 patients (47.62%) that did not want elective surgery, respectively (P = 0.016). There were no significant differences between patients when compared between age groups and presence of comorbidities.

Patient insight and impact of patient education

There were 162 patients (87.57%) that accepted the reasoning behind the delay of elective surgery in response to the COVID-19 pandemic. The detailed results for the assessment of patient insight are depicted in Table 1. After receiving patient education there were 100 patients (54.05%) that still wanted TJA despite the COVID-19 pandemic and 85 patients (45.95%) that did not want elective surgery at the earliest opportunity (Figure 2). Over half the patients (100 patients/54.05%) wanted TJA despite the COVID-19 pandemic (continued demand group) after counseling. There were 21 patients (11.35%) that opted out of surgery as the earliest opportunity despite COVID-19 (defer group) both before and after patient education. There were 64 patients (34.59%) that changed their opinion after receiving patient education (receptive group).

The receptive group previously wanted TJA despite the COVID-19 pandemic and subsequently opted out of elective surgery after receiving patient education. The results for questions regarding patient insight were compared between the continued demand group, the defer group and the receptive group (Table 3). The importance to delay elective surgery was recognized 81.97% of the receptive group compared to 91.4% and 100% of the continued demand and defer groups, respectively (P < 0.000). Similarly, 76.67% of the receptive group were aware of the increased risks associated with COVID-19 if infected peri-operatively, compared to 91.75% and 100% of patients from the continued demand and defer groups, respectively (P = 0.046). There were 44 patients (73.33%) from the receptive group that understood there would be no visitors allowed to see them in hospital after surgery compared to 85 (91.75%) and 20 (95.24%) patients from the continued demand and defer groups, respectively (P = 0.018). Lastly, 43.33% of the receptive group were aware of the increased risks for death associated with COVID-19 compared to 77% and 85.71% of patients from the continued demand and defer groups, respectively (P = 0.001).

Continued demand for TJA despite the COVID-19 pandemic

The patient characteristics and perception of pain and function since the postponement of TJA was of interest regarding the continued demand group. The results for questions regarding pain and function were compared between the continued demand group, the defer group and the receptive group (Tables 4 and 5). Patients in the continued demand group were awaiting TJA for a mean period of 24.7 mo (SD: 20.38, range: 3-132 mo). The mean length of time for patients awaiting TJA in the Defer group was 25.32 mo (SD: 40.54, range: 4-200 mo) and in the receptive group was 28.91 mo (SD: 37.82, range: 4-264 mo), respectively. Increased joint pain was experienced by 60.61% of the continued demand group compared to 33.33% and 53.12% of defer and receptive groups, respectively (P = 0.035). The mean NRS pain score for the continued demand group was 7.68 (SD: 2.14; range: 2-10) compared to 5.9 (SD: 3.2; range: 0-10) and 7.24 (SD: 1.8; range: 2-10) for defer and receptive groups, respectively (P < 0.000). There was decreased functionality due to joint pain for 75.51% of the continued demand group since the postponement of surgery compared to 50% and 60.94% of

Table 2 Pain and function responses compared between patients that wanted total joint arthroplasty despite the coronavirus disease 2019 pandemic (Yes) to patients that did not want elective surgery as soon as possible (No)[1]

Current state in comparison to before TJA postponement	Want TJA despite COVID-19 pandemic		*P* value
Function	Yes, *n* (%)	No, *n* (%)	
Functionality due to joint pain			0.002
Much less	26 (16.05)	0 (0)	
Less	89 (54.94)	8 (38.1)	
Same	42 (25.93)	8 (38.1)	
More	2 (1.23)	4 (19.05)	
Much more	3 (1.85)	1 (4.76)	
Walking distance			0.034
Much less	27 (16.56)	3 (14.29)	
Less	55 (33.74)	3 (14.29)	
Same	77 (47.24)	11 (52.38)	
More	3 (1.84)	4 (19.05)	
Much more	1 (0.61)	0 (0)	
Sitting			0.63
Much less	15 (9.2)	3 (15.97)	
Less	53 (32.52)	4 (21.05)	
Same	90 (55.21)	11 (57.89)	
More	5 (3.07)	1 (5.26)	
Sleep			0.572
Much less	21 (12.88)	4 (19.05)	
Less	21 (12.88)	4 (19.05)	
Same	94 (57.67)	10 (47.62)	
More	19 (11.66)	1 (4.76)	
Much more	8 (4.91)	2 (9.52)	
Pain	Yes, *n* (%)	No, *n* (%)	
Joint pain			0.037
Decreased	20 (12.27)	3 (15.79)	
Same	48 (29.45)	10 (52.63)	
Increased	95 (58.28)	6 (31.58)	
Access to pain medication			0.714
No	30 (27.03)	5 (35.71)	
Yes	81 (72.97)	9 (64.29)	
Need for pain medication			0.05
Much less	6 (3.87)	2 (10)	
Less	8 (5.16)	4 (20)	
Same	65 (41.94)	9 (45)	
More	44 (28.39)	3 (15)	
Much more	32 (20.65)	2 (10)	
	Yes, mean (± SD)	No, mean (± SD)	*P* value

NRS pain score	7.54 ± 2.02	3.09 ± 3.27	< 0.000

[1]Yes (n = 164); No (n = 21). COVID-19: Coronavirus disease 2019; NRS: Numerical rating scale; SD: Standard deviation; TJA: Total joint arthroplasty.

Table 3 Mental health responses compared between patients that wanted total joint arthroplasty despite the coronavirus disease 2019 pandemic (Yes) to patients that did not want elective surgery as soon as possible (No)[1]

Mental health responses	Want TJA despite COVID-19 Pandemic, *n* (%)		*P* value
	Yes	No	
Weight change since TJA postponement			0.423
Lost	30 (27.03)	3 (18.75)	
Same	50 (45.05)	6 (37.50)	
Gained	31 (27.93)	7 (43.75)	
Feelings of isolation or loneliness			0.89
Yes	51 (32.48)	8 (34.78)	
No	106 (67.52)	15 (65.22)	
Anxiety to get infected with COVID-19			0.133
No	15.43	14.29	
Minimal	10.49	14.29	
Neutral	9.88	28.57	
Moderate	26.54	19.05	
Severe	37.65	23.81	
Anxiety to spread COVID-19 to relatives			0.016
No	26 (16.46)	2 (9.52)	
Minimal	13 (8.23)	4 (19.05)	
Neutral	9 (5.7)	5 (23.81)	
Moderate	35 (22.15)	4 (19.05)	
Severe	75 (47.47)	6 (28.57)	
Anxiety about finances due to COVID-19			0.785
No	16 (10.06)	2 (9.52)	
Minimal	36 (22.64)	4 (19.05)	
Neutral	70 (44.03)	12 (57.14)	
Moderate	19 (11.95)	1 (4.76)	
Severe	18 (11.23)	2 (9.52)	

[1]Yes (n = 164); No (n = 21). COVID-19: Coronavirus disease 2019; TJA: Total joint arthroplasty.

patients in the defer and receptive groups, respectively (P = 0.043).

DISCUSSION

In our study, 88.65% of patients awaiting TJA wanted elective surgery as soon as possible despite the current COVID-19 pandemic. Similarly, a study by Brown *et al*[14] in the united states demonstrated that almost 90% of patients wanted to reschedule elective TJA as soon as possible. A study conducted in the United Kingdom found that only 56.8% of patients for TJA wanted their elective surgery as soon as possible[15]. Additionally, Brown *et al*[14] reported that 85% of patients agreed with the decision to cancel elective surgery in response to the COVID-19 pandemic in the united states.

Table 4 Pain and function responses compared between the continued demand group, defer group and receptive group[1]

Current function in comparison to before TJA postponement	Continued demand group, *n* (%)	Defer group, *n* (%)	Receptive group, *n* (%)	*P* value
Functionality due to joint pain				0.043
Much less	15 (15.31)	0 (0)	9 (14.06)	
Less	59 (60.20)	10 (50)	30 (46.88)	
Same	19 (19.39)	6 (30)	24 (37.5)	
More	2 (2.04)	3 (15)	0 (0)	
Much more	3 (3.06)	1 (5)	1 (1.56)	
Walking distance				0.118
Much less	21 (21.21)	2 (10)	7 (10.94)	
Less	29 (29.29)	4 (20)	25 (39.06)	
Same	46 (46.46)	11 (55)	31 (48.44)	
More	2 (2.02)	3 (15)	1 (1.56)	
Much more	1 (1.01)	0 (0)	0 (0)	
Sitting				0.518
Much less	12 (12.12)	2 (11.11)	4 (6.25)	
Less	29 (29.29)	4 (22.22)	23 (35.94)	
Same	53 (53.54)	11 (61.11)	37 (57.81)	
More	5 (5.05)	1 (5.56)	0 (0)	
Sleep				0.643
Much less	13 (13.13)	3 (15)	9 (14.06)	
Less	15 (15.15)	4 (20)	6 (9.38)	
Same	50 (50.51)	10 (50)	43 (67.19)	
More	14 (14.14)	1 (5)	5 (7.81)	
Much more	7 (7.07)	2 (10)	1 (1.56)	
Current pain in comparison to before TJA postponement	Continued demand group, *n* (%)	Defer group, *n* (%)	Receptive group, *n* (%)	*P* value
Joint pain				0.035
Decreased	10 (10.10)	3 (16.67)	10 (15.62)	
Same	29 (29.29)	9 (50)	20 (31.25)	
Increased	60 (60.61)	6 (33.33)	34 (53.12)	
Access to pain medication				0.792
No	19	5	11	
Yes	51	9	30	
Need for pain medication				0.068
Much less	5 (5.26)	2 (10.53)	1 (1.67)	
Less	7 (7.37)	4 (21.05)	1 (1.67)	
Same	34 (35.79)	9 (47.37)	31 (51.67)	
More	26 (27.37)	3 (15.79)	17 (28.33)	
Much more	23 (24.21)	1 (5.26)	10 (16.67)	
NRS pain score, mean (± SD)	Continued demand group	Defer group	Receptive group	*P* value
	7.68 ± 2.14	5.9 ± 3.2	7.24 ± 1.8	< 0.000

[1]Continued demand (n = 100); Defer (n = 21); Receptive (n = 64). NRS: Numerical rating scale; SD: Standard deviation; TJA: Total joint arthroplasty.

Table 5 Responses for Insight Perception Regarding coronavirus disease 2019 compared between the continued demand group, defer group and receptive group[1]

Insight responses	Continued demand group, *n* (%)	Defer group, *n* (%)	Receptive group, *n* (%)	*P* value
Healthcare system response to COVID-19				
Aware no elective surgery				0.951
Yes	73 (74.49)	15 (75)	48 (75)	
No	25 (25.51)	5 (25)	16 (25)	
Fair no elective surgery				0.710
Yes	82 (82.83)	17 (85)	57 (89.06)	
No	17 (17.17)	3 (15)	7 (10.94)	
Important to delay elective surgery				< 0.000
Yes	85 (91.4)	21 (100)	50 (81.97)	
No	8 (8.6)	0 (0)	11 (18.03)	
Knowledge of preventative measures				
Hand washing				0.441
Yes	69 (69.70)	14 (66.67)	41 (64.06)	
No	30 (30.30)	7 (33.33)	23 (35.94)	
Social distancing				0.441
Yes	69 (69.70)	14 (66.67)	41 (64.06)	
No	30 (30.30)	7 (33.33)	23 (35.94)	
Wearing mask in publicYes	68 (68.69)	14 (66.67)	41 (64.06)	0.489
No	31 (31.31)	7 (33.33)	23 (35.94)	
Peri-operative patient considerations for COVID-19				
Routine pre-operative screening				0.016
Yes	94 (94)	18 (85.71)	44 (73.33)	
No	6 (6)	3 (14.29)	16 (26.67)	
Increased morbidity if COVID-19 positive				0.046
Yes	89 (91.75)	21 (100)	46 (76.67)	
No	8 (8.25)	0 (0)	14 (23.33)	
No visitors allowed				0.018
Yes	85 (91.4)	18 (85.71)	44 (73.33)	
No	8 (8.6)	3 (14.29)	16 (26.67)	
Increased mortality if COVID-19 positive				0.001
Yes	77 (77)	18 (85.71)	26 (43.33)	
No	23 (23)	2 (14.29)	34 (56.67)	

[1]Continued demand (n = 100); Defer (n = 21); Receptive (n = 64). COVID-19: Coronavirus disease 2019.

This is reflected in our study of a sub-Saharan Africa population with 87.57% of patients accepting the need to delay elective TJA procedures. There is a demonstrated need to postpone elective surgery, particularly in high-risk patients and re-initiation

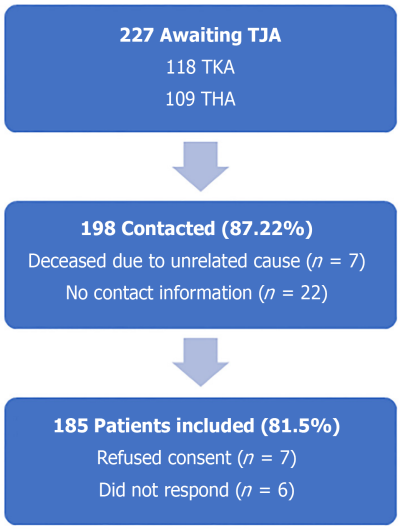

Figure 1 Flowchart of the study cohort. THA: Total hip arthroplasty; TJA: Total joint arthroplasty; TKA: Total knee arthroplasty.

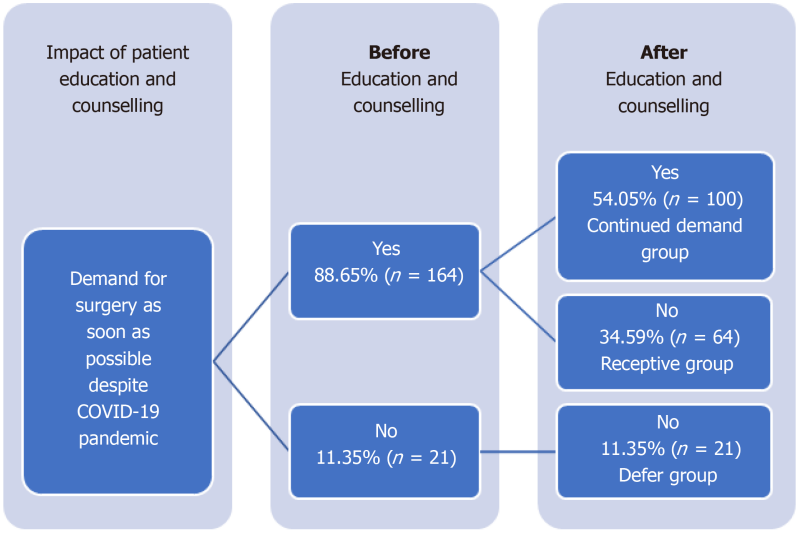

Figure 2 Patient demand for total joint arthroplasty before and after receiving education and counseling. COVID-19: Coronavirus disease 2019.

should be careful and gradual.

Patients with comorbidities, particularly those with cardiac diseases, hypertension and diabetes mellitus, have increased risks for morbidity and mortality if infected with COVID-19[16,17]. In our study, patients with comorbidities were 8.45-fold less likely to want elective surgery at the earliest opportunity compared to those with no comorbid conditions (P = 0.0128). Similarly, Chang *et al*[15] reported that patients classified ASA I (60.5%) and ASA II (60.0%) were more likely to agree to undergo earlier elective TJA after the COVID-19 pandemic compared to ASA III (44.4%) and ASA IV (0%) patients (P = 0.01). A multicenter study by Kayani *et al*[16] assessed the impact of COVID-19 infection on peri-operative outcomes for patients undergoing surgical treatment for hip fractures. COVID-19 positive patients had increased post-operative mortality rates (P < 0.001), increased risk of post-operative complications (P < 0.001) and more critical care unit admissions (P < 0.001) compared to COVID-19 negative patients[16]. Furthermore, COVID-19 positive patients with greater than 3 comorbidities had a significantly higher risk for mortality compared to those with no comorbidities (P < 0.001)[16].

The waiting period for elective TJA is high in our sub-Saharan setting when compared to other reported rates worldwide. In our study, the mean length of time for patients awaiting THA was 28.29 mo and 25.03 mo for TKA. In 2018, the average median worldwide waiting time for elective THA was 113 d (range: 50-282 d) and 189 d (range: 45-839 d) for TKA with wide variation, across countries[18]. Initially, longer

waiting period was associated with increased patient demand for elective surgery at the earliest opportunity despite the COVID-19 pandemic in our study. Patients awaiting TJA for between 1 and 3 years were 3.34-fold more likely to want elective surgery at the earliest possibility compared to those awaiting surgery for less than 1 year ($P < 0.000$). A systematic review including 15 studies of patients awaiting TJA for osteoarthritis was conducted to assess the impact of wait times on pain and functional status[19]. There was a mean waiting period between 42-399 d with strong evidence that pain and WOMAC score did not deteriorate for patients waiting less than 180 d[19]. Similarly, a multicenter study with a mean wait time of 5.07 mo by Vergara *et al*[20] observed that patients waiting less than 3 mo had a greater likelihood of achieving successful post-operative outcomes on the WOMAC scale and the 36-item short form survey scores. Furthermore, a multicenter study including 7151 patients found that longer waiting periods were significantly associated with a lower Oxford Hip Score at 12-mo follow-up after THA[21]. Patients waiting 12 and 24 mo had a post-operative mean difference of 2.6 and 4.2 Oxford Hip Score points, respectively compared to those waiting less than 6 mo[21].

In our study, 55.49% of patients had increased joint pain and 67.2% of patients had decreased functionality respectively, since the postponement of their TJA. Patients that wanted TJA despite the COVID-19 pandemic experienced significantly greater decrease in function compared to those who were prepared to wait. This was demonstrated by significant differences in decreased functionality due to joint pain ($P = 0.002$) and decreased walking distance ($P = 0.034$) respectively. Additionally, patients between the ages of 45 to 60 years had significantly more decreased functionality due to joint pain compared to patients younger than 45 years of age (78.5% *vs* 46.3%; $P = 0.015$). Brown *et al*[14] in their survey of TJA patients in the united states reported that joint pain had increased for 54% of patients and activity levels had decreased for 50% of patients, respectively since their surgery cancellation. This has long-term implications as several studies have demonstrated significantly less improvement in WOMAC and 36-item short form survey scores for patients with lower baseline function compared to those with higher baseline function persisting through 24 mo follow-up after TJA[12,13]. A recent study by Scott *et al*[11] demonstrated that patients with low scores on the Euro Qol five-dimension general health questionnaire achieved significantly worse joint-specific Oxford scores and satisfaction rates 1 year after TJA, compared with those with higher scores pre-operatively ($P < 0.001$).

Patient consent prior to elective surgery during the COVID-19 pandemic must focus on counseling and education, particularly for high-risk patients. Our study found that the percentage of patients who wanted elective surgery at the earliest opportunity decreased from 88.65% to 54.05% after receiving patient education about the COVID-19 pandemic. Patients in our study that were in the receptive group had significantly less insight on the impact of COVID-19 regarding both their individual health and the response of the healthcare system. Patients in the receptive group were less likely to be aware of the increased morbidity ($P = 0.046$) and mortality ($P = 0.001$) associated with COVID-19 if infected peri-operatively when compared to non-infected patients. A purposeful patient education program was implemented by the orthopedic department of the New York University Langone Health in response to the COVID-19 pandemic[6]. Orthopedic surgeons counseled patients regarding need for the postponement of surgery due to the COVID-19 pandemic and addressed patient concerns and questions which alleviated their anxiety[6].

In our study, the continued demand group had been awaiting surgery for a shorter length of time (24.7 mo) than the defer group (25.32 mo) and the receptive group (28.91 mo). Despite the shorter waiting period, the continued demand group experienced significantly greater pain than other patients. The continued demand group had a higher mean pain score ($P < 0.000$) and the greatest proportion of patients with increased joint pain ($P = 0.035$) since the postponement of surgery compared to the other patient groups.

There are unique challenges that must be considered during the re-initiation of elective surgery. Rizkalla *et al*[22] proposed that the decision to proceed with either primary or revision hip arthroplasty should be assessed for urgency. The urgency to proceed with hip arthroplasty should be based on both the potential harm of delaying surgery and the potential risk of performing surgery in the context of COVID-19[22]. In addition to patient outcomes, the economic implications of the postponement of elective surgery place an increasing burden on healthcare systems[23,24]. There have been several guidelines developed to facilitate the return of elective surgery in many parts of the world[23,24]. The reinstitution of elective surgery must be carefully implemented to ensure patient and staff safety and the responsible management of

healthcare resources and equipment[23,24]. Waiting lists should no longer operate on a first-in, first-out basis as was previously used in our institution. The effect of TJA postponement on patients should be assessed on an individualized basis and waiting lists should be prioritized for urgency.

One of the weaknesses of our study is that the waiting period was already long in comparison to worldwide rates. An additional limitation is that the interview was done telephonically, however, to mitigate this there were two individuals conducted interviews and all conversations were recorded.

CONCLUSION

Patient education and counseling are essential for those who have had elective procedures postponed during the COVID-19 pandemic. South Africa has longer waiting periods for TJA in comparison to international reports and the further postponement of surgery increases the risk of poor post-operative outcomes. There is deterioration in patients' physical and mental health whilst awaiting TJA and should be individually reassessed before rescheduling their surgery. Waiting lists should be prioritized for urgency with the re-initiation of elective surgery based on their current overall health status.

ARTICLE HIGHLIGHTS

Research background

The postponement of elective surgery in response to the coronavirus disease 2019 (COVID-19) pandemic resulted in a total shutdown of total joint arthroplasty (TJA). The impact of elective surgery postponement has resulted in the cancellation of approximately 92.6% TJAs in Europe. The demand for TJA is already high and waiting lists continue to grow with 150000 procedures per month postponed in the United States.

Research motivation

There is wide variation across countries worldwide; with the average median waiting time of 113 d (range 50-282 d) for total hip arthroplasty and 189 d (range 45-839 d) for total knee arthroplasty respectively. Patients awaiting surgery longer than 6 mo and those with poor pre-operative baseline function have demonstrated increased risks for poor outcomes after TJA. The unprecedented postponement of elective TJA in response to the COVID-19 pandemic may impact patients awaiting surgery.

Research objectives

Our aim was to assess the impact of TJA postponement on the physical and mental health of patients awaiting elective surgery. We secondarily sought to determine the demand for TJA and average waiting time for our South African population. Additionally, we investigated the role of patient insight after providing education and counseling regarding the healthcare system's response to the COVID-19 pandemic. The effect of TJA postponement on patients should be considered with the re-initiation of elective surgery and waiting lists should be prioritized to optimize outcomes.

Research methods

A prospective cross-sectional telephonic interview-based study of patients awaiting TJA at an academic referral institution in South Africa during the COVID-19 pandemic. We recorded baseline demographic data and length of time awaiting surgery and demand for TJA. A 5-point Likert scale was used to determine the degree to which the patient felt the postponement of surgery had affected various characteristics of their physical and mental health. We assessed patient insight regarding elective surgery cancellation in response to the COVID-19 pandemic and subsequently re-evaluated demand for TJA after providing education and counseling.

Research results

Patients with comorbidities were 8.45-fold less likely to want elective surgery at earliest possibility compared to those with no comorbid conditions (P = 0.013). In our study in South Africa, the mean length of time for patients awaiting total hip

arthroplasty was 28.29 mo and total knee arthroplasty was 25.03 mo, respectively. Before and after receiving patient education, the number of patients who demanded elective TJA decreased respectively, from 164 patients (88.65%) to 100 patients (54.05%) (continued demand group). The continued demand group had a higher mean pain score ($P < 0.000$) and the greatest proportion of patients with increased joint pain ($P = 0.035$) since the postponement of surgery compared to the other patients.

Research conclusions

The effect of TJA postponement on patients should be assessed on an individualized basis and waiting lists should be prioritized for urgency. Patient consent prior to elective surgery during the COVID-19 pandemic must focus on counseling and education, particularly for high-risk patients, to ensure optimal outcomes. The urgency to proceed with TJA should be based on both the potential harm of delaying surgery and the individual risk profile of performing surgery incurred by each patient, respectively, in the context of the COVID-19 pandemic.

Research perspectives

There is a demonstrated need to postpone elective surgery in response to the COVID-19 pandemic, particularly in high-risk patients. Patients should be reassessed and thoroughly counseled prior to rescheduling their elective procedures, particularly those at increased risk for morbidity and mortality if infected with COVID-19 perioperatively. In addition to the potential negative impact on patient outcomes, the economic implications of the postponement of elective surgery place an increasing burden of healthcare systems worldwide. The reinstitution of elective surgery must be carefully implemented to ensure patient and staff safety and the responsible management of institutional resources.

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