


Almost 79% survival rate at 10-year follow-up for the patellofemoral joint arthroplasty: An Italian prosthetic registry study

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Abstract

Purpose: The aims of the present study were (1) to evaluate the survival of patellofemoral joint (PFJ) arthroplasty in a large cohort of patients using data obtained from an Italian regional arthroplasty registry and (2) to collect clinical outcomes of a subgroup of patients, with a minimum follow-up of 4 years. The hypotheses were that PFJ arthroplasty is a procedure that had good survival and clinical outcomes, not inferior to those reported in the literature for primary total knee arthroplasty (TKA).

Methods: The Register of Orthopaedic Prosthetic Implants (RIPO) of Emilia-Romagna (ER) (Italy) database was searched for the inclusion of all PFJ arthroplasties implanted between 2003 and 2019. PFJ arthroplasties were excluded if they were implanted in patients who lived outside of the ER. The survival information was extrapolated from the RIPO considering the partial or total revision of the implant as failure; moreover, a subgroup of patients was contacted and interviewed by telephone to collect clinical outcomes. Descriptive statistics were used to summarise the data. The survival curve was calculated and plotted using the Kaplan–Meier method.

Results: A total of 126 arthroplasties in 114 patients were included in the final analysis (mean age at surgery 60.1 ± 11.5 years old). The main causes of patellofemoral arthroplasty were primary osteoarthritis (88%) and posttraumatic arthritis (7%). The survival was 90.4 ± 30.6 and 78.8 ± 51.5 at 5 and 10 years of follow-up, respectively. At the latest follow-up, 23 implants failed (18.3%). The main cause of revision was osteoarthrosis progression (34.8%). A total of 44 patients were contacted by telephone to collect clinical outcomes: Western Ontario and McMaster Universities Osteoarthritis Index, functional Knee Society Score, Forgotten Joint Score and Oxford Knee Score. These patients reported good to excellent scores at a medium follow-up of 10.3 ± 4.7 years.

Conclusions: The PFJ showed good survival and clinical outcomes and could be considered a valuable option for patients affected by isolated patellofemoral osteoarthritis.

Abbreviations: FJS, Forgotten Joint Score; KKSf, functional Knee Society Score; OA, osteoarthritis; PFJ, patellofemoral joint; PROM, patient-reported outcome measure; RIPO, Register of Prosthetic Orthopaedic Implants; TKA, total knee arthroplasty; WOMAC, Western Ontario and McMaster Universities Arthritis Index.

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KEYWORDS

arthroplasty registry, patellofemoral joint arthroplasty, PFJ, registry study, survivorship

INTRODUCTION

Patellofemoral osteoarthritis (OA) can be caused mainly by primary degenerative changes, generally in patients over 60 years old presenting symmetrical wear of the joint, by patellofemoral instability, in patients who have a history of recurrent patellar dislocation, trochlear dysplasia and patellar malalignment or secondarily to patellofemoral fractures [16].

When the joint degeneration leaves no room for conservative treatment (analgesic, targeted exercises, injection with viscosupplementation and platelet-rich plasma) or biological surgery (autograft and allograft transfer, two-stage open autologous chondrocyte implantation, mesenchymal cell induced chondrogenesis), prosthetic replacement of the patellofemoral joint (PFJ) represents a valuable solution, as Kamat et al. suggested in a recent review [15].

Although many surgeons still prefer a total knee arthroplasty (TKA) as treatment of isolated patellofemoral OA [14], the increased invasiveness [9], bone loss [12] and the risk of subsequent revisions in younger patients [10, 13] have led to an increasing interest in PFJ arthroplasty. Indeed, the latter is correlated with less blood loss, shorter hospital stay [7], preservation of bone stock and ligaments [22] and better functional outcomes and stair-climbing abilities [17] concerning TKA. A recent systematic review of nine studies [24] compared PFJ and TKA and found no significant differences in clinical outcomes; however, PFJ-operated patients had better quality of life in the first 2 years and better postoperative range of motion.

The survivorship of PFJ arthroplasties has been investigated in clinical and registry studies, with an average rate of 83% at 10 years follow-up; moreover, the revision rate showed a decrease in recent years, probably due to the introduction of new implant designs [4, 18, 20, 21].

The present study aimed to investigate the survivorship of PFJ prosthesis in a large cohort of patients using data obtained from a regional arthroplasty registry and to collect clinical outcomes of a subgroup of patients, with a follow-up time between 4 and 19 years. The hypotheses were that PFJ arthroplasty is a procedure that had good survival and clinical outcomes, not inferior to those reported in the literature for primary TKA.

MATERIALS AND METHODS

Cohort selection and data collection

The database of the Register of Orthopaedic Prosthetic Implants (RIPO) was searched for all PFJ arthroplasties performed between 2003 and 2019. The RIPO was established at the Istituto Ortopedico Rizzoli in Emilia-Romagna (ER), an Italian region with 4.5 million inhabitants and collects data related to hip, knee and shoulder arthroplasty procedures performed in the region. RIPO's data include the following information: demographic; diagnosis leading to replacement; implant model and design; and surgeon and the hospital in which performing the procedure. Any surgical procedure performed anywhere in Italy is reported and billed to the patient's region of residence. The primary endpoint of the registry is the revision of one or more prosthetic implant components [8].

In ER, 64 hospitals are performing primary knee implants; PFJ arthroplasties have been implanted in 21 hospitals by 28 orthopaedic surgeons. A percentage of 60% of the procedures were performed by senior surgeons.

PFJ arthroplasties were excluded if they were implanted in patients who lived outside of the ER to minimise bias due to loss of follow-up: if a patient residing outside the ER has primary surgery in this region but revision surgery outside, RIPO does not capture it and survival data would be biased.

Survival times of unrevised arthroplasties were calculated considering the last date of observation (date of death or 31 December 2022). The endpoint was the revision of at least one component, for any reason.

Furthermore, patients who were treated in our department were contacted and telephonically interviewed to collect patient-reported outcomes measures (PROMs). The investigated scores were Western Ontario and McMaster Universities Osteoarthritis Index (WOMAC), functional Knee Society Score (KSSf), Forgotten Joint Score (FJS) and Oxford Knee Score.

The criteria for inclusion of this subgroup of patients was the implantation of the patellofemoral prosthesis between the years 2000 and 2019 at our Department II Clinic Rizzoli Orthopaedic Institute.

The detailed demographic and clinical information about the study cohort and subgroup of patients are reported in Tables 1 and 2. Diagram 1 showed the criteria for the inclusion and exclusion of patients.

Ethics

Ethics approval was not necessary for survivorship analysis as the data was collected as a standard clinical practice by the regional registry utilised. Additionally, all information was collected and analysed in a deidentified format that protects patient privacy. For the subgroup analysis of clinical outcomes, study approval by the Institutional Review Board of Istituto Ortopedico Rizzoli was obtained (CE-AVEC 450/2023/Oss/IOR).

Data analyses

The statistical analysis was performed using SPSS 14.0 for Windows, version 14.0.1 (SPSS Inc.) and JMP, Version 12.0.1 (SAS Institute Inc., 1989–2007). Survival analysis was performed with the Kaplan–Meier estimator. The clinical outcomes were reported as mean and standard deviation.

TABLE 1 Demographics data of the study cohort.

	<i>n</i>	%
Sex		
Female	89	70.6
Male	37	29.4
Side operated		
Right	66	52.4
Left	60	47.6
Body mass index ^a		
Normalweight	37	32.8
Overweight	46	40.7
Obese	30	26.5
Diagnosis		
Primary patellofemoral arthritis	111	88.1
Posttraumatic and sequelae fractures	7	5.6
Deformity	1	0.8
Patello-femoral necrosis	1	0.8
Others	6	4.7
Revision causes		
Osteoarthritis progression	8	34.8
Pain without loosening	6	26.1
Aseptic loosening	5	21.7
Infection	3	13.0
Others	1	4.3

Abbreviations: BMI, body mass index; *n*, number of patients.

^aBMI is unknown in 10.3% of the arthroplasties.

TABLE 2 Demographics data of the subgroup of patients.

No of implants	45
No of patients	44
Age at surgery (years)	53.1
Range	(31–72)
Gender (%)	
Female	75
Male	25
Side operated (%)	
Right	52.3
Left	47.7
BMI (%)	
Overweight	43.2
Obese	11.4

Abbreviation: BMI, body mass index.

RESULTS

A total of 301 PFJ arthroplasties were performed between July 2000 and December 2019 in the ER region. Patients who lived outside the region were excluded, thus, a total of 126 PFJs (II generation—'Onlay') in 114 patients were included in this retrospective analysis. The mean age of the patients was 60.1 ± 11.5 years old. The mean follow-up time was 7.7 ± 3.9 years. The main diagnosis leading to the implant was primary patellofemoral OA (88.1%), followed by posttraumatic OA (7.2%). Patients who experienced failure underwent revision surgery with TKA in all cases.

At the latest follow-up, 23 implants failed (18.3%). The causes of revision were OA progression (34.8%), pain without loosening (26.1%), aseptic loosening (21.7%), infection (13%) and others (4.3%). Reintervention time was more than 3 years in 56.5% of cases. The survivorship of the implant was 90.4% (95% confidence interval [CI]: 83.8–94.5) at 5 years and decreased to 78.8% (95% CI: 68.4–86.4) at 10 years follow-up (Figure 1).

A subgroup of 44 patients were contacted by telephone to collect clinical outcomes: good to excellent scores at medium follow-up of 10.3 ± 4.7 years were recorded: WOMAC 83.5 ± 22.6 ; KSSf 83.9 ± 24.8 ; FJS 88.4 ± 20.3 and Oxford Knee Score 39.7 ± 11.0 .

DISCUSSION

The main finding of the present study was that PFJ arthroplasty had good overall survivorship and excellent clinical outcomes at a mean of 10 years of follow-up, not

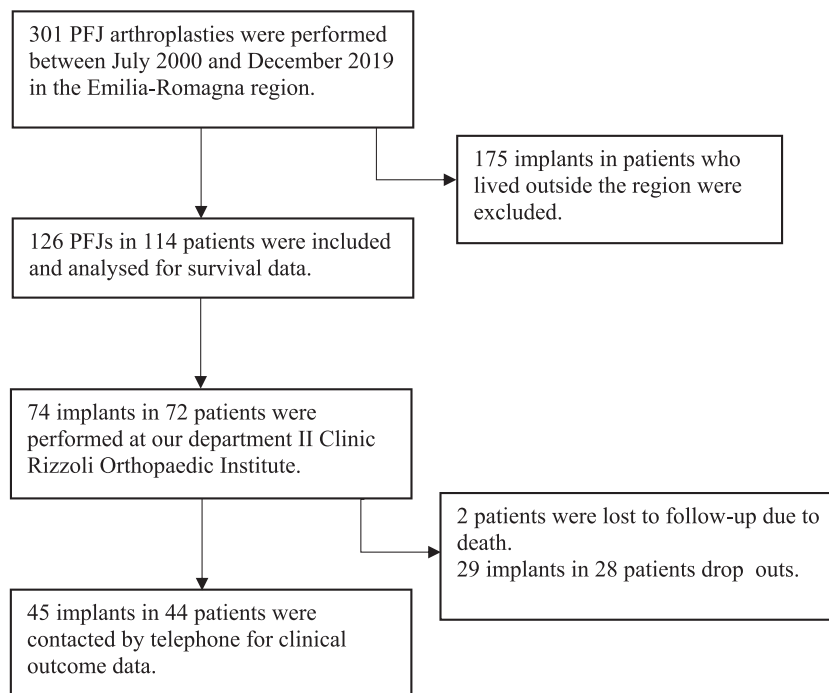


DIAGRAM 1 Patient inclusion and exclusion criteria. PFJ, patellofemoral joint.

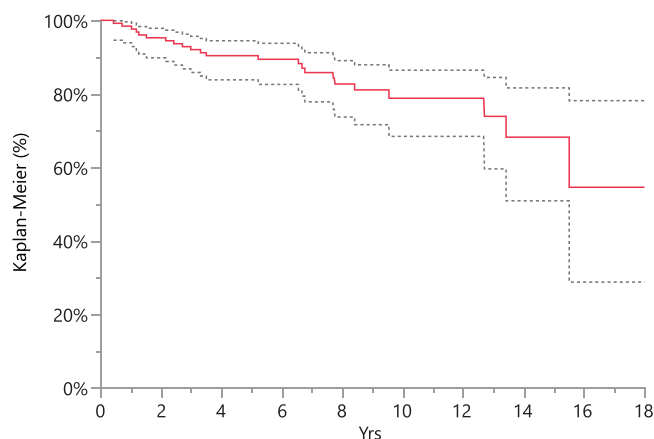


FIGURE 1 Kaplan–Meier curve describing patellofemoral joint arthroplasty survivorship.

inferior to those reported in the literature for TKA. This registry study collected the evaluation of a vast number of procedures and showed that PFJ can be used safely in patients with isolated patellofemoral OA.

Recent articles that evaluated the survival of PFJs reported satisfactory results. Ackroyd et al. [2] reported on 109 patients a survival rate of 95.8% at mid-term (mean follow-up of 5 years). Also, Nicol et al. [22] published a report on 103 PFJ arthroplasty founding a revision rate of 14% at a mean follow-up of 7.1 years. In line with these articles, our survival rate was 90.4% and 78.8% at 5 and 10 years of follow-up.

Interestingly, previous research provided conflicting results on the topic, and this controversy could be explained by analysing the history and development of patellofemoral arthroplasties.

Historically, the reason for the worse survival of PRJs was the type of implant. In the 1970s, the first PFJ arthroplasty was introduced using an ‘Inlay’ technique. This technique involved the arthroplasty of femoral cartilage without altering the conformation of the subchondral bone. This type of prosthesis, named first-generation, had unsatisfactory postoperative results: high rates of reoperation (26%–63%) and revision (19%–51%) [4, 20]. Therefore, in the 1990s, second-generation ‘Onlay’ PFJ was introduced: anterior femoral cut as in total prostheses (arthroplasty of both trochlear cartilage and subchondral bone), trochlear component implanted perpendicular to the femoral axis and parallel to the transepincondylar line, the possibility of variation in the position of the femoral component, wider trochlear component and a more valgus flange angle [7, 19]. In a recent systematic review of Sava et al., a higher rate of OA progression was observed in the onlay design group versus the inlay design group [24].

Many authors underlined the importance of performing a less invasive surgery such as the mono-compartmental patellofemoral arthroplasties instead of the total prosthesis in patients who have patellofemoral arthrosis. A meta-analysis by Dy et al. [9] comparing the incidence of reoperation after PFJ arthroplasties and TKA found that complications, reoperation rate and

revision arthroplasty rate were significantly higher after the use of first-generation designs. A more recent systematic review and meta-analysis by Choundhury et al. [6] highlighted better KSS and lesser chances of PFJ arthroplasties complications favouring a modern implant design over its traditional counterpart. In 2023, Vella-Baldacchino et al. [24] showed that there was no difference in revision risk and survival between PFJ and TKA at 5 years of follow-up.

The causes of PFJ arthroplasty failure have been widely described in the literature, and the most common is OA progression in tibio-femoral compartments, which requires the implantation of a TKA [18, 3]. The same data were reported in the present study, with the OA progression being the cause of implant revision in 34.8% of the cases, a result similar to the one highlighted by a recent systematic review, which identified tibiofemoral cartilage degeneration as a reason for failure in the 42% of cases [3].

Regarding clinical scores, in line with our subgroup of patients in which Oxford Knee Score was 39.7 ± 11.0 at 10 years of follow-up, Ackroyd and Chir [1] showed that the median Oxford score improved from 19 points to 38 at 2 years and 40 at 5 years in a substantial study of 306 PFJs. van der List et al. [18] described that at 10-year follow-up, 83.3% of the patients retain their PFJ and that on average 82.7% of these patients report good or excellent knee function, 69% of patients who undergoing PFJ have good or excellent function and could theoretically postpone the need for TKA by 10 years.

In the literature, differences in clinical outcomes between PFJ and TKA were not found to be statistically significant. In 2019, Bunyoz et al. in a systematic review [5] showed that the postoperative mean Oxford Knee Score was not statistically significant at the 2-year follow-up between PFJ and TKA. In a recent systematic review and meta-analysis by Elbardey et al. [11], midterm results of WOMAC and KSS of second-generation patellofemoral arthroplasty versus TKA on isolated patellofemoral OA showed no statistically significant differences comparing the two types of arthroplasties at a 5-year follow-up. In addition, this study showed how, however, PFJ had less postoperative blood loss and how PFJ was an economically beneficial joint-preserving procedure. In 2023, Vella-Baldacchino et al. [24] confirmed that PFJ and TKA are both viable options for patients with primary PFJ OA: no significant difference in PROMs and knee function-specific scores, but better postoperative range of motion in patients who had PFJ in the first two years of follow-up were found.

Clinically, this study showed how PFJ can be equated with TKA in survival outcomes and subjective clinical scores and highlighted that PFJ remains a procedure with less blood loss, shorter hospital stay [7], preservation of bone stock and ligaments [23] and better functional outcomes and stair-climbing abilities [17].

This study has some limitations, mainly because the data included in the RIPO registry are standardised but not complete, the information about the subjective outcomes was collected only in our subgroup of patients, and it only includes cases from the region ER. In addition, the article is a case series, and a comparison with a hypothetical control group with TKA was not performed. It was also not possible to perform a subgroup analysis on the implants used (all second-generation), due to the small sample size. Lastly, another limitation was the variability in the volume of hospitals and surgeons who performed PFJs: 21 hospitals by 28 orthopaedic surgeons (60% senior surgeons).

However, per every registry study, one of the most valuable features was the vast number of procedures evaluated, which is very difficult to match in trials and case series.

CONCLUSION

PFJ arthroplasty is a procedure that has good survival and clinical outcomes and can be confidently proposed to patients affected by isolated patellofemoral OA.

AUTHOR CONTRIBUTIONS

Anna Pagano, Piero Agostinone and Domenico Alesi participated in the study design and drafted the manuscript. Piero Agostinone and Dalila Caputo performed the statistical analysis, Anna Pagano and Alberto Grassi collected the data and contributed to performing statistical analysis. Maria Pia Neri and Stefano Zaffagnini conceived of the study, participated in coordination and helped to draft the manuscript. All authors read and approved the final manuscript.

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CONFLICT OF INTEREST STATEMENT

Stefano Zaffagnini: Smith & Nephew, Depuy consultant and Medacta, Depuy research support. The remaining authors declare no conflict of interest.

DATA AVAILABILITY STATEMENT

Data are available from the corresponding author.

ETHICS STATEMENT

This study obtained the approval from Institutional Review Board (IRB) of Rizzoli Orthopaedic Institute (CE-AVEC 450/2023/Oss/IOR). Each patient signed informed consent before taking part in the study.

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SUPPORTING INFORMATION

Additional supporting information can be found online in the Supporting Information section at the end of this article.

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