Orthopaedics & Traumatology: Surgery & Research xxx (2017) xxx–xxx

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Original article/Work of the SOO (the Orthopedics and Traumatology Society of Western France)

Ambulatory unicompartmental knee arthroplasty: Short outcome of 50 first cases☆

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ARTICLE INFO

Article history:
Received 25 November 2016
Accepted 9 October 2017

Keywords:
Unicompartmental knee arthroplasty
Fast-track
Local anesthetic
Ropivacaine
Local infiltration analgesia
One day surgery
Ambulatory

ABSTRACT

Introduction: The reduction in length of stay (LOS) in orthopedic surgery has been steady for several years. For the past 3 or 4 years in France, the trend toward outpatient surgery has been growing upwards, as it is a goal for hospital administration.
Materials and methods: This is a prospective, continuous, mono-centric, single operator study on 56 UKAs. Included were all UKAs carried out between January 2014 and December 2015, meeting the following criteria: voluntary patients, supportive family environment, absence of comorbidity (oral anticoagulants, diabetes, obesity), ASA score ≤ 3. Preoperatively, patients received: Dexamethasone 2 mg/10 kg, Tranexamic acid 2 g, Cefazolin 2 g IV. All patients were operated on under general anesthesia with the same technique: Alpina® (Zimmer-Biomet) uni-prosthesis without tourniquet. The arthrotomy was closed after a capsular injection of a solution of 150 mg Ropivacaine + 30 mg Bi-Profenid®. Patient discharge on the same day evening was authorized by both surgeon and anesthesiologist. Three criteria were quantified: number of patients seen before the date of the first consultation for the removal of stitches (around day 12), Visual Pain Scale (10 points scale) on the first 12 days, and the level of satisfaction at the one-month postoperative visit.
Results: Six patients (11%) were not included in the ambulatory program during the initial consultation. Three patients were not able to be discharged on the same day evening due to nausea and therefore remained hospitalized for one night. Eighteen patients (38%) were reviewed before D10: 13 patients were reviewed between D1 and D4 for bleeding through the dressing and 5 for pain not controlled by level 1 and 2 analgesics. The Visual Pain Scale (VPS) reached level 6 ± 2 by the 2nd day and then dropped to 1 ± 1 by the 12th day. At 1 month, 85% of the patients were satisfied or very satisfied with their care. There were no general or localized complications.
Discussion: Ambulatory UKA surgery is possible for most patients. The inclusion rate for ambulatory UKA was 88% for Berger RA in 2010, therefore very close to this study rate of 89%. Ambulatory care is not only a change in surgical and anesthetic practice but a totally new management process involving all medical and non-medical actors. Ambulatory UKA surgery is feasible and safe for most patients.
Level of evidence: IV, retrospective cohort study.

1. Introduction

Over the past two decades, there has been a growing interest in the use of unicompartmental knee arthroplasty (UKA) in patients with isolated unicompartmental osteoarthritis. The explanation for the increase can be found in quicker short-term recovery, decreased post-operative pain and decreased morbidity compared to total knee arthroplasty (TKA) [1]. The operative techniques have also improved thanks to a minimally invasive approach (MIS) that reduces both soft tissue damage and disruption of the extensor mechanism [2]. The techniques of "rapid recovery pathways" or "fast-track" have been applied for more than 10 years to hip and knee replacements [3]. The fast-track surgery can be defined as "the synergistic, beneficent effect on convalescence achieved by adding multi-modal evidence-based care principles and combining these with optimized logistics" [4]. Improvements in perioperative care regarding analgesia, anesthesia, nursing care and rehabilitation have led to a pronounced reduction of length of stay (LOS). Efficient

☆ Article issued from the SOO (the Orthopedics and Traumatology Society of Western France).

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https://doi.org/10.1016/j.otsr.2017.10.004
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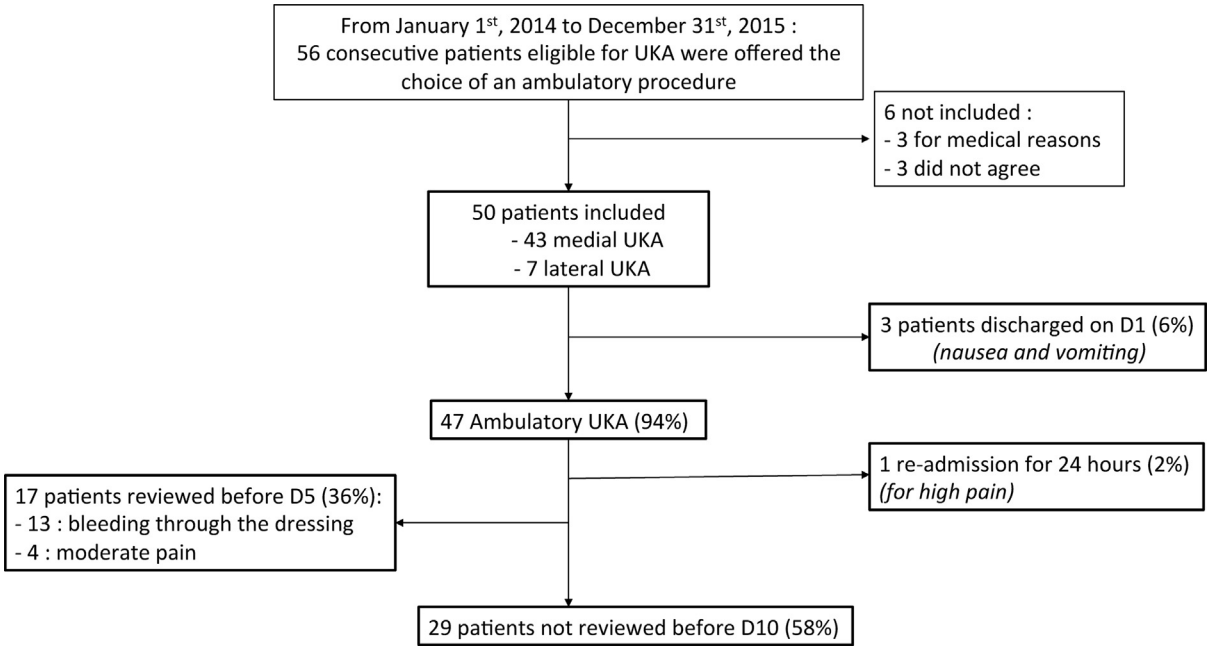

Fig. 1.

pain treatment is essential and a prerequisite for early mobilization and shorter LOS in hospital [5]. Over the last decade, LOS with discharge to home after primary THA and TKA has decreased from about 5–10 days to about 2–4 days in selected series and larger nationwide series [6]. Cross et al. and Berger et al. showed that reducing the inpatient stay after knee arthroplasty could be achieved not only without compromising patient safety, but also without compromising patient satisfaction [7]. More generally, patient outcome and satisfaction after total joint replacement seem to increase while the inpatient stay decreases [8–11].

However, UKA is still considered by most surgeons to be an inpatient surgery requiring in-hospital care post-operatively. Patients who stay a few days in the hospital after UKA do so mostly because of surgeons' concern for post-op complications and patients' concern around inadequate pain control at home [12]. Outpatient surgery is growing slowly in France, especially when it comes to arthroplasty, despite being it is a goal for hospital administration and health care system for economic considerations and health care quality improvement. For instance in 2009, only 36% of surgical interventions in France were ambulatory, while it was more than 80% in the United States the same year [13]. Beside economic and psychological considerations, scientific factors might help explain this difference [14].

The objective was to assess the early outcome of a continuous prospective series of 50 outpatient UKAs, and identify all possible medical and surgical problems.

2. Material and methods

From 1 January 2014 to 31 December 2015, 56 consecutive patients where offered the option to undertake an ambulatory UKA, and followed prospectively. All patients were informed and consented to providing data for anonymous use and a written informed consent was obtained before surgery. The option of UKA was subjected to the inclusion criteria: voluntary patient less than 80 years suffering from monocompartmental osteoarthritis or osteonecrosis, with reducible frontal deviation and no flessum greater than 5°, with competent cruciate ligaments. Excluded were: revision of UKA, associated major or symptomatic patellofemoral osteoarthritis, varus or valgus deformity greater than 15°, severe comorbidity i.e. ASA score > 3 (American Society of Anesthesiologists classification, used to stratify medical co-morbidities), or oral anticoagulant. Patients were seen preferably the same day by the anesthesiologist to select candidates for outpatient surgery. Six out of 56 patients were excluded: 3 for medical reasons (diabetes and anticoagulation) and 3 declined to be outpatient (Fig. 1). The consecutive cohort of 50 patients included 33 men and 17 women; 43 underwent medial UKA and 7 patients underwent lateral UKA. Mean age was 66.7 years (range, 42–78 years). Body mass index (BMI) was $28 \pm 4\,kg/m^2$ (range, 18–40 kg/m^2). In our series, 7 patients were ASA 1, 38 were ASA 2 and 5 were ASA 3. The indications were osteoarthritis (46 cases) and osteonecrosis (4 cases) (Table 1).

Table 1
Demographic data of the cohort study (50 UKAs from 2014 to 2015).

Variable	Value
Sex	
Female	17 (44%)
Male	33 (66%)
Localization of osteoarthritis	
Medial	43 (86%)
Lateral	7 (14%)
Age 66.7 years	42–78
BMI (kg/m^2)	28.4 ± 4
ASA score (physical status classification system)	
One	7 (14%)
Two	38 (76%)
Three	5 (10%)

All the patients (inpatients and outpatients) attended a preoperative education class taught by an orthopedic surgeon, a clinical nurse and a physiotherapist, as described by Sanders et al. [15]. At this teaching class, the procedure and complications were discussed in detail, and expectations were set that patients would be discharged home on the day of surgery. Information about pain was given by the nurse to ensure that patients knew what to expect and what was expected from them. The physiotherapist instructed the patients on how to get out of bed after surgery, walk with one or

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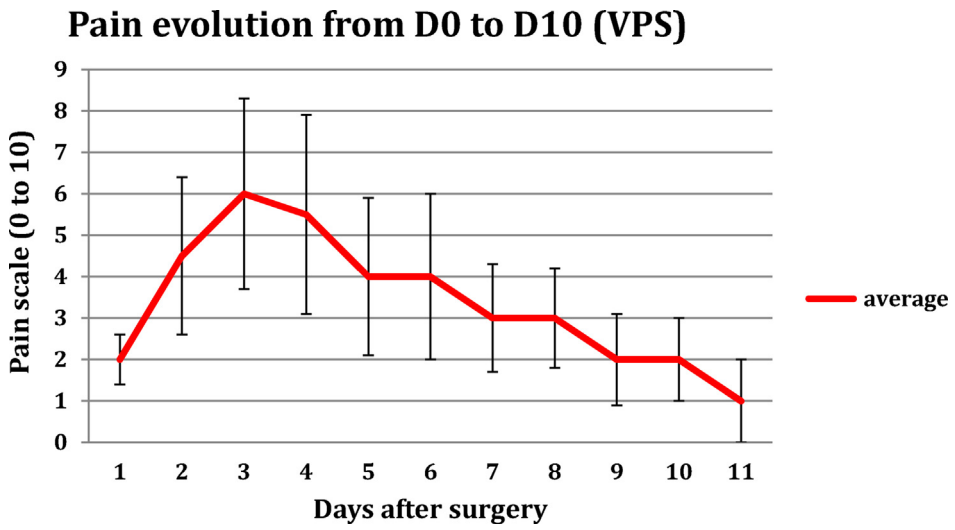

Fig. 2. Visual Pain Scale (VPS) evolution from D1 to D11 after surgery: average and SD.

two crutches, get dressed, and go up and down stairs. Outpatients were admitted on the day of surgery and UKAs were performed before noon, under general anesthesia. The patients received at induction prophylactic antibiotics (Cefazolin 2 g), dexamethasone (2 mg for 10 kg) and Tranexamic acid (dose 1 g if weight < 100 kg, 1.5 g if weight > 100 kg) 30 min before incision. One experienced knee surgeon (HR) implanted all the uncemented, fixed bearing, medial or lateral Alpina UKAs (Zimmer-Biomet, 69800 Saint-Priest, France) [16] with manual instrumentation using a minimally invasive medial or lateral parapatellar approach. The procedure was performed without tourniquet, through an incision from 8 to 10 cm. The low aggressive surgery included making in situ bone cuts, not dislocating the patella and preserving the extensor mechanism. The local infiltration analgesia (LIA) consisted of 20 mL Ropivacaine (7.5 mg/mL) and 30 mg Bi-Profenid®. In cases of contraindications to the use of NSAIDs, Bi-Profenid® was omitted from the mixture and postoperative medication. LIA was done using a 20 mL syringe and 10 cm long 19 G spinal needle. The injection was done in two stages. Firstly into the tissues around the posterior joint capsule before the components were set in place; secondly, in the muscular and aponeurotic edges of the incision before closure. The needle was inserted parallel to the aponeurotic edges into the sub synovial space to a depth of 30 mm and injection was done as the needle was withdrawn. No injection was done in the subcutaneous tissue so that the liquid could spread from below. No intra articular drain or epidural catheter was left in the knee. A compression bandage was used to reduce knee swelling and to increase the effect of the LIA [17]. Cooling by ice packs was advised during the first 5–7 days. After completion of the surgery, patients were transferred to the recovery room where they could start moving the knee in flexion and extension. After 2 h, patients were transferred to the outpatient unit in the early afternoon where they received lunch and oral pain medication (Paracetamol, Tramadol). The perfusion was taken out after a second dose of antibiotics (Cefazolin 2 g). Physiotherapy started by sitting patients on the side of the bed and progressed if they were symptom free. Crutches were used as needed as determined by the physiotherapist or the nurse. The dressing was changed before discharge. Both the surgeon and the anesthesiologist granted discharge according to post-anesthetic discharge scoring system for home readiness after ambulatory surgery [18] (pain was moderated, walking was possible and effective, and vital signs were stable). Advice was given for auto-mobilization of the knee: walking with full weight-bearing, prevention of flexum, and repeated icing several times a day. The patients were discharged with an analgesic prescription (Paracetamol 4 g/day and Tramadol 200 mg/day for 10 days), NSAID (Bi-Profenid® 200 mg/day), a short acting opioid (Morphine sulfate 20 mg/day for 5 days) and an oral anticoagulant (Apixaban 5 mg/day for 14 day). Outpatients were discharged home accompanied by a relative to drive them.

They were provided with a daily summary table measuring pain (Visual Pain Scale (VPS) from 0 (no pain) to 10 (maximal pain)), medication taken, nausea, and any problems or side effects of medications. They filled in the table until the 12th day and returned it to the nurse on D12 when the stitches were removed. All the patients were contacted by phone on D1 and D3 by a nurse. If there were any problems regarding dressing, nausea, or inadequate pain control, patients were encouraged to report before D12. All patients were reviewed at the outpatient clinic on days 12 and 30 by a nurse and the senior surgeon. Medical complications (nausea, cardiac infarction, gastrointestinal bleeding, stroke, deep venous thrombosis and pulmonary embolism) were reported, if occurring. The patients were questioned on their satisfaction levels at one month postoperatively. They had the choice between 3 answers: "I am very satisfied" with the procedure, "I am satisfied", "I am not satisfied".

2.1. Statistical analysis

All data were recorded using Microsoft Excel software (Microsoft Corp., Redmond, WA). The average and SD score for NRS were calculated for outpatients for the first 10 days.

3. Results

Forty-seven patients (94%) were discharged the day of surgery, while 3 who suffered from nausea and vomiting were discharged on D1 (5%). Eighteen patients (38%) were reviewed before D5, 13 for bleeding through the dressing, 4 for moderate pain and 1 for high pain intensity leading to a re-admission for 24 h. Pain score according to the VPS increases from D0 to D2 (VPS: 6 ± 2) and then decreases until D10 (VPS: 1 ± 1) (Fig. 2). Worst pain was generally recorded on D2 when the effectiveness of LIA decreased.

No serious cardiac, renal or gastric side effects or complications directly related to the LIA technique were recorded during the first 10 days or at one month postoperatively. Fifteen patients (32%) among those discharged the day of surgery reported nausea, but there were no need for medication. During the first postoperative month, there was no blood transfusion, no thromboembolic events,

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Table 2
Comparison of the US study and our study.

Studies	Years	No. of UKAs	Inclusion rate for ambulatory UKAs	Percentage of outpatient surgery	Type of anesthesia	Local infiltration analgesia (LIA)	Cause of failure of outpatient surgery	Rate of readmission	Serious complications
Berger et al.	2009	25	88%	96%	SA 100%	No	Nausea (4%)	0%	0%
Cross et al.	2014	105	100%	100%	SA 100%	No	0%	0%	1% (infection)
Kort et al.	2015	20	59%	85%	GA or SA	Yes	Anxious to go home or Pain (15%)	5%	4% (stiffness)
Gondusky et al.	2014	160	100%	100%	GA 100%	No	0%	1% (pain)	2% (dislocation, hematoma)
Current study	2017	50	90%	94%	GA 100%	Yes	Nausea (6%)	2% (pain)	0%

no wound necrosis nor superficial or deep infection, no mobilization for stiffness under anesthesia.

At one month, 40 patients were very satisfied (80%) with the procedure, 5 were satisfied (10%) and 2 were not (4%).

4. Discussion

The main finding of this study was that using a fast-track strategy enables an outpatient UKA procedure that is both feasible and safe, for the large majority of selected patients. Furthermore, it does not affect patient satisfaction. In our series, 94% of the included patients underwent an ambulatory surgery and 80% of the patients were very satisfied with the outpatient procedure. There were no severe complications. However, one has to admit that outpatient care needs a strong and specific organization, as 38% of our patients needed to be seen in consultation before D5.

This work has several limitations. The main one being that there were no control groups so we do not assess the potential for benefit for the patients. The series is limited to 50 outpatient UKAs over 2 years. Since the end of the study, 32 more outpatient UKAs in 2016 were operated on using the same protocol with identical results. The data were only collected during the first postoperative month, which may exclude any general or local complications that occurred later on. There were no comparisons with other anesthetic techniques (SA, RA).

The reduction of LOS after surgery of hip (THA) or knee (TKA) has been witnessed for several years, especially since the use of fast-track multidisciplinary strategy [12]. Improvements in perioperative care (anesthesia, analgesia, nursing care) and in rehabilitation have led to a pronounced reduction of LOS to about 1 to 3 days. In short-stay groups (1 or 2 days), pain and stiffness are reduced compared to standard group (3, 4 or 5 days), indicating an improvement in joint function and quality of life with reduced stay [19]. This may be the result of better pain control and early mobilization of the knee. In selective cases, UKA can be performed on an outpatient basis [20]. Kort et al. reported that out of a series of 20 UKA, 17 (85%) were discharged on the day of surgery [20]. Cross et al. and Gonduski et al. reached 100% outpatients in 2 large series of more than 100 UKA [7,21] (Table 2).

Postoperative pain is the most common reason for delayed discharge or unanticipated hospital readmission, no matter the surgery [22,23]. Pain management is known to be dependent on both anesthesia and analgesia.

The type of anesthesia chosen in this study is debatable [24,25]. Fast-track should be safe, minimize the impact of surgical stress response and facilitate the transition from anesthesia to a very early postoperative ambulation (2–3 h). We opted for a general anesthesia (GA) combined with a LIA, and not for a spinal anesthesia (SA) nor for a regional anesthesia (RA). Anesthesiologists may find SA to have a better safety profile than GA but we chose the combination of GA and LIA rather than SA to avoid the risk of overdose of local anesthetics, and to avoid undesirable SA side effects, such as urinary retention or sustained neurological deficit on lower limb motor function. Only one study compared GA and SA in fast-track TKA [26]: GA resulted in shorter LOS, less nausea and vomiting, less pain and less use of opioids, and patients were able to walk earlier; meaning that GA would facilitate early recovery. Furthermore, immediate mobilization results in fewer thromboembolic episodes [27].

Intra-articular and peri-articular LIA has gained popularity due to obvious reasons (pain originates from the surgical wound), simplicity, low price and the fact that the quadriceps remains effective, thus facilitating early mobilization and ambulation postoperatively. Intra-articular LIA might have toxic effects on chondrocytes, according to Breu et al. but this remains hypothetical in vivo [28–30]. Various drugs are used for LIA, mostly Bupivacaine and Ropivacaine providing low pain scores for 24–36 h [4]. The injected mixture for LIA in this study included only Ropivacaine and Bi-Profenid®. The total amount of 150 mg of Ropivacaine injected into the wound is below the Ropivacaine toxicity threshold [26]. Central nervous system symptoms and cardiovascular effects have been reported at venous plasma Ropivacaine concentration ranging from 1 to 2 μg/ml after iv administration [31]. Other authors also use adrenaline [4]. We stopped using adrenaline due to a major skin complication after a TKA performed in 2013. We also chose not to use intra articular catheter, as suggested by several authors, to avoid risks of joint infection associated with re-injection by a nurse at patient's home the day after surgery [4]. Besides, for Kehlet et al. there is no clear evidence for a role of later post-operative LIA administration through a catheter [25]. Despite these two differences in pain control, using the same pain score (NRS), there were no differences between our series and those of other authors [4]. Peripheral nerve blocks (femoral nerve block) may also, like LIA, reduce postoperative pain but are associated with a risk of falling because of quadriceps muscle inhibition [32]. Continuous nerve blocks have been shown to reach complication rates above 13% [32]. The adductor canal block is promising in preserving quadriceps strength but seems technically demanding and time consuming [33].

The key to a successful pain management in fast-track UKA is a multimodal opioid-sparing analgesia where different drugs are combined to produce a synergistic pain-reducing effect with low need for opioids. Reduced use of opioids avoids undesirable side effects (sedation, dizziness, nausea) that would delay discharge. Paracetamol and NSAIDs/COX-2 inhibitors have been shown to reduce pain, inflammation and the need for opioids [34]. Baverel et al. showed that opioid consumption was a risk factor of delayed discharge after outpatient ACL surgery, whereas use of NSAIDs was shown to be protective [32]. However, to avoid any resumption of severe pain after 24–36 h (after the effect of LIA is exhausted), we prescribed small doses of short-acting morphine (Morphine sulfate 20 mg per day maximum) from D1 to D5. From our point of view, it would prevent unanticipated hospital readmission because of uncontrolled pain at home. We only recorded one 24 h-long re-admission at D2 for pain not controlled by the oral painkillers prescribed, and 4 patients were reviewed at D4 because they were

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worried by the intensity of pain (NRS 5–8). Stronger analgesics (Morphine sulfate) helped control the pain for these hyperalgesic patients. In a series of 105 ambulatory UKAs, Cross et al. had no hospital readmission within the first week post surgery [7]. In a series of 86 outpatient TKAs, there were 4 readmissions, due to anemia, gastrointestinal bleeding, deep venous thrombosis and nausea [7]. In this study, we had 13 dressing changes during consultation between D1 and D4, because patients were told to come back if there were anything whatsoever that might worry them. These events that occurred during the first 12 days are benign and cannot be considered as a failure of outpatient treatment. However, this clearly shows that outpatient care needs a specific orthopedics department organization, as some patients might be worried during the first days after surgery, and will need to be taken care of. There were no thromboembolic, cardiac or infectious complications after one month. We found no studies on early UKA follow-up (first month) allowing comparison on the assessment of pain or the state of the dressing. On studies with more follow-up, a multimodal approach has been shown to reduce LOS without increasing hospital readmission rates. Using a fast-track multimodal strategy allows early mobilization after surgery, which is associated with shorter LOS [35]. Besides, immediate mobilization results in fewer thromboembolic episodes [27]. In a large study group of 6000 THAs and TKAs, Khan et al. showed a statistically significant reduction in cardiac ischemic events, blood transfusion and mortality when using a fast-track procedure compared to a traditional strategy [12]. The use of Tranexamic acid reduces transfusion rate confirming its efficacy in reducing perioperative blood loss. This was not accompanied by any increase of embolic complications or ischemic heart disease [12]. Reducing blood loss leads to a reduction in LOS as blood transfusion is associated with longer hospital stays [35].

Patients were trained to walk with crutches during preoperative education classes so that they had no apprehension when resuming full weight bearing and mobilizing the knee after surgery. Also, muscle control was effective straight away after GA contrary to SA or RA. In a fast-track protocol, 90% of the TKA patients are able to walk by themselves on D2 with moderate pain intensity [36].

Reduction of LOS should be done gradually, especially in prosthetic surgery, and in parallel with the mastering of principles of fast-track. A proper patient screening for outpatient UKA is essential. Reducing LOS too quickly may have negative consequences such as an increase in thromboembolic events, joint dislocations and loosening [37]. A one-day surgery pathway involves an extensive change in mindset for patients, dedicated multidisciplinary teams and hospital management. In fact, one of the major factors explaining the variability in LOS is the organizational issue in the hospital [38]. The outpatient strategy could eventually result in a reduction of costs with comparable or better patient satisfaction [39].

5. Conclusion

Outpatient UKA is feasible and safe but the whole option is challenging for the surgeon and staff, and thus eligibility of both patients and institutions must be clearly defined. The outpatient process is quite new and represents an ongoing process with lots of expected improvements including above all the characteristics of LIA. In addition, shortening the stay might be beneficial for patients, but needs to be confirmed by further studies.

Disclosure of interest

The authors declare that they have no competing interest.

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Please cite this article in press as: Ruiz N, et al. Ambulatory unicompartmental knee arthroplasty: Short outcome of 50 first cases. Orthop Traumatol Surg Res (2017), https://doi.org/10.1016/j.otsr.2017.10.004