

# Halved admission time and satisfied patients following minor orthopedic surgeries using Procedural Sedation Analgesia (PSA): a prospective cohort study

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## Abstract

**Aim:** To determine whether minor orthopedic surgery, performed by physician assistants, using Procedural Sedation Analgesia (PSA) is safe, and to determine admission time and patient satisfaction.

**Methods:** Data of patients operated using PSA was collected for a year and compared to a control group.

**Keywords:** Procedural Sedation Analgesia, orthopedic surgery, patient satisfaction, admission time, physician assistant.

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**Results:** All patients in the PSA group (N=72) were satisfied, there was no significant difference in complications between the groups and admission time was almost halved ( $3.4 \pm 1.1$  vs  $6.3 \pm 1.5$  hours,  $p < 0.001$ ).

**Conclusion:** Performing minor orthopedic surgery, performed by physician assistants, using PSA was safe. Patients were satisfied and admission time was almost halved.

## Introduction

The COVID-19 pandemic, which emerged in late 2019, had a major impact on the global healthcare system. A lot of elective surgery had to be canceled, resulting in long waiting lists[1, 2]. In the Netherlands, approximately 20% less primary total hip, knee, and shoulder arthroplasty surgeries were performed during the global pandemic in 2020. Part of this capacity gap was filled by private hospitals, but because of the lack of an intensive care unit, private hospitals only performed surgery on relatively healthy patients[3, 4]. Long waiting lists for inpatient orthopedic surgeries arose, especially for those patients in need of major and/or complex surgery[5].

Quite around the same time, the National Health Care Institute and the Dutch Healthcare Authority (Nederlandse Zorgautoriteit, NZa) published an advisory report stating what is needed to realize so-called 'appropriate care'[6], in response to increasing healthcare costs around the world[7]. Appropriate care refers to care that works at a reasonable cost, and is one of the themes in the Dutch Integral Care Agreement[8].

This agreement, signed by parties from healthcare, support, and welfare sectors, supports the movement towards appropriate care[10]. By definition, appropriate care is value-driven, occurs together with and around the patient, takes place in the right place and is about health rather than illness[8]. This movement towards affordable and accessible care for all patients had thus begun in the Netherlands, when long waiting lists for inpatient orthopedic surgeries emerged as a consequence of the COVID-19 pandemic. Therefore, solutions that could address both problems were desirable

Orthopedic surgery is normally performed under general anesthesia, spinal anesthesia, or a peripheral nerve block. The role of anesthesia evolved, because of the increasing pressure to reduce admission time and increase efficiency[11]. Over the last few years, procedural sedation analgesia (PSA) is increasingly being used to relieve pain, anxiety, and discomfort during invasive, therapeutic, and diagnostic procedures[12-14]. For a moderate or deep sedation Propofol can

be used, an intravenous anesthetic drug[15]. Propofol has a short acting working mechanism, which leads to a rapid induction of sedation when administration is started, and a quick recovery when administration is stopped [16, 17]. As such, PSA with Propofol is used in a wide variety of procedures outside the operating room[16-19]. In orthopedic surgery, Propofol induced PSA is normally used in combination with spinal anesthesia[20, 21]. However, whether performing orthopedic surgery using only PSA is safe, specifically for minor procedures such as removal of hardware, is currently unknown.

The capacity of orthopedic surgeons, who are trained for major and complex orthopedic procedures, had to be maximized in the early years of the 20th decade to address the long waiting lists. Inpatient operating rooms needed to be available to serve those patients in need for major and/or complex orthopedic surgery. This encouraged us to have the relatively minor procedures performed by physician assistants (PA) in an outpatient operating room under PSA instead. A PA is a trained healthcare professional who takes over medical tasks from the specialist. They completed a three-year master's degree after being a paramedic or a nurse[22, 23]. In the past few years, the amount of PAs has considerably increased in the Dutch healthcare system and they tend to play a big role in achieving 'appropriate care'[24, 25].

The aim of this study was to determine whether minor orthopedic surgery performed by two PAs using PSA alone was safe, and to determine its impact on admission time and patient satisfaction.

## Methods

This single center prospective cohort study with historical control was conducted in a large secondary teaching hospital in the Netherlands. Approval for the study was granted in line with local research policies. Due to the nature and design of data collection, informed consent was waived.

## Patients

Between February 2023 and February 2024, patients aged  $\geq 16$  years in need of percutaneous Achilles' tendon lengthening or removal of hardware (ROH) for fractures of fibula, clavicle or olecranon, after hallux valgus correction, or after tibial tubercle osteotomy were asked if they were willing to undergo surgery using PSA alone in an outpatient operating room. All procedures were performed by two PAs with a background as surgical technologists. A historical control group was formed by patients aged  $\geq 16$  years undergoing the same procedures between February 2022 and January 2023 in the inpatient operating room by an orthopedic surgeon and/or orthopedic resident.

For both groups, patient characteristics were retrieved from the electronic health records. These included age, gender, body mass index (BMI), American Society of Anesthesiologists (ASA) physical status classification, and whether patients were smokers. Furthermore, the procedure type and admission time were collected.

## Procedures

All PSA patients were screened for eligibility preoperatively by a sedation specialist. The patients were admitted 30 minutes before surgery to the daycare unit. They entered the outpatient operating room in their own clothing. The PSA was administered by the sedation specialist, after which the two PAs performed the procedure. After surgery, the patients were put to bed and brought to the recovery room. Postoperative instructions were according to standard protocols. Patients were called one day post-surgery by one of the PAs to identify any complications and to assess satisfaction.

Control patients were screened by an anesthesiologist. Patients were admitted 60-90 minutes before surgery to the daycare unit, where they received an operating gown and were put into a bed. In the operating room, patients received general or spinal anesthesia, administered by an anesthesiologist. An orthopedic surgeon and/or orthopedic resident performed the procedure. After surgery, patients were brought to the recovery room where they stayed as long as needed. All patients were called one day post-surgery by a daycare nurse.

## Statistical analysis

All data was collected and analyzed using IBM SPSS Statistics 28.0 (IBM Corp., Armonk, NY, USA), with statistical significance set at  $p < 0.05$ . Normality of continuous data was assessed using the Shapiro-Wilk test. Data were considered normally distributed if the W statistic exceeded 0.90, and data were described by means with standard deviations (SD). Otherwise, medians and interquartile ranges (IQR) were used. Categorical data were described by counts and frequencies. Differences in patient characteristics, admission time in hours, and complications between PSA patients and control patients were compared using independent t-tests (normally distributed continuous data), Mann-Whitney U tests (non-normally distributed continuous data), or Chi-square tests (categorical data).

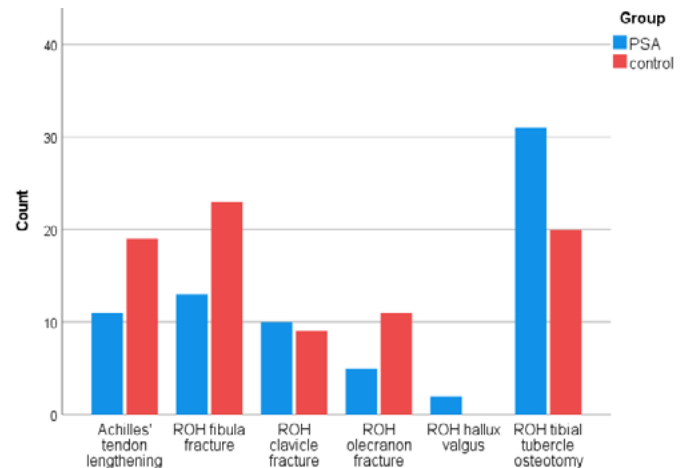
## Results

A total of 72 patients underwent minor surgery using PSA during the study period, while the historical control group comprised 82 patients. Patient characteristics of PSA and control patients are summarized in Table 1. The overall median age was 31.0 (21.0–54.0) years, 106 (69%) patients were female, mean BMI was  $26.1 \pm 5.0$  kg/m<sup>2</sup>, most patients were scored ASA II (56%), and 19% were smokers. No differences between groups were found in these characteristics (all  $p > 0.05$ ). The procedure types per group are depicted in Figure 1.

**Table 1** Patient characteristics of PSA and control patients.

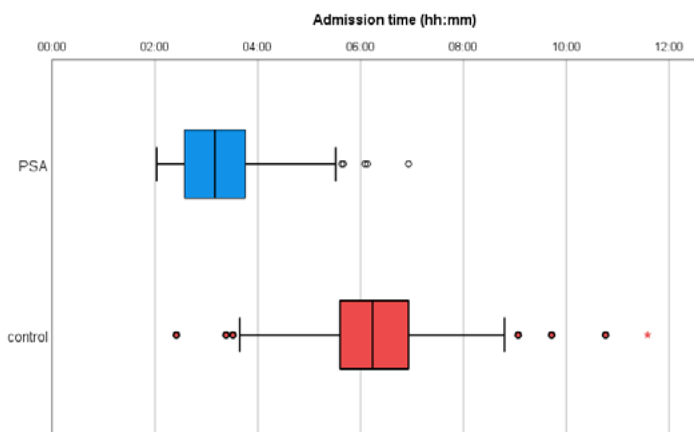
	PSA patients (n=72)	Control patients (n=82)	p-value
Age (years) <sup>a</sup>	30.5 (20.0-44.5)	34.5 (22.0-58.0)	0.086
BMI (kg/m <sup>2</sup> ) <sup>b</sup>	25.9 $\pm$ 5.0	26.2 $\pm$ 5.1	0.661
Female gender <sup>c</sup>	55 (76%)	51 (62%)	0.058
ASA classification <sup>c</sup>			
I	32 (44%)	26 (32%)	
II	37 (52%)	49 (60%)	
III	3 (4%)	7 (8%)	
Smoking <sup>c</sup>	14 (19%)	16 (20%)	0.992

<sup>a</sup> presented as median (IQR); <sup>b</sup> presented as mean  $\pm$  SD; <sup>c</sup> presented as count (%). PSA, procedural sedation analgesia; BMI, body mass index; ASA, American Society of Anesthesiologists.



**Figure 1** Procedure types for PSA (n=72) and control patients (n=82).

All PSA patients indicated to be satisfied. The admission time was significantly lower in PSA patients compared to controls ( $3.4 \pm 1.1$  versus  $6.3 \pm 1.5$  hours,  $p < 0.001$ ; Figure 2). Regarding complications, in the PSA group, one patient reported a postoperative bleeding after which a new pressure bandage was administered at the emergency room. Another patient had a thrombophlebitis who received blood thinners for 6 weeks. In the control group, three patients had a postoperative infection which were treated with antibiotics. Statistically, no differences in complications were observed (2.8% versus 3.7%,  $p = 0.758$ ).



**Figure 2** Admission time for PSA (n=72) and control patients (n=82).

## Discussion

This study aimed to determine whether performing minor orthopedic surgery using PSA alone, in an outpatient operating room by two PAs was safe. Furthermore, we aimed to determine whether this shift in

approach – driven by the waiting lists resulting from the COVID-19 pandemic – had any impact on admission time and complications following surgery. The results showed that minor orthopedic surgery performed by PAs using PSA was safe, and leads to almost halved admission time compared to patients who underwent minor orthopedic surgery in an inpatient setting by an orthopedic surgeon.

To our knowledge, this is the first study that has investigated performing minor orthopedic procedures using PSA alone in a more simple and therefore more efficient setting. Compared to the former standard protocol (i.e., under spinal or general anesthesia, performed by an orthopedic surgeon), we showed that following this new approach, mean admission time for patients undergoing Achilles' tendon lengthening or ROH was reduced by 46%. This reduction can be explained by several changes in the process. Firstly, patients do not have to come in until an hour later, namely 30 minutes instead of 90 minutes before surgery. Second, by using PSA alone, patients generally experience less nausea and vomiting[26]. Finally, patients can leave the hospital as soon as the discharge criteria are met[27]. Despite not having examined healthcare costs in this study, with this relevant reduction in admission time as well as redeployment of medical staff, it is plausible to argue that this new approach leads to reductions in healthcare costs[26].

In this study, we observed complication rates of respectively 2.8% and 3.7% in the PSA and control group. The most commonly performed procedure was ROH (81% of all procedures), which also happens to be one of the most executed orthopedic surgeries in the Netherlands. Although it is a relatively minor procedure, ROH is not without risks. Literature shows an overall complication rate of 9.6%, with complication rates of 9.9% for the ankle and 13.8% for the knee[28]. The most commonly reported complications following ROH are wound healing problems (2.1%) and infections (1.6%)[28]. Compared to these numbers, the complication rate in the PSA group was much lower, and we had no wound healing problems or infections. It must be noted, however, that the PSA group contained only relatively healthy patients with low ASA grades. It is known that patients with higher ASA scores have a higher risk of complications[29].

Interestingly, the findings of the current study indicate that our new approach can contribute to achieving 'appropriate care'[10]. Current healthcare is under pressure due to increasing healthcare demand, fewer available healthcare providers, and higher healthcare costs. Appropriate care responds to this by reducing the pressure on healthcare providers, offering patients care that better suits them, with less increase in healthcare costs. Although our new approach was mainly driven by the long waiting lists that arose during the COVID-19 pandemic, it also appears to respond to all these facets of appropriate care.

Limitations of this study warrant some consideration in interpreting our findings. First, the inpatient group was a historical control group. However, since these patients underwent surgery in the preceding year, changes over time were hardly expected and the patient characteristics were similar to the PSA group. Therefore, we assume that this had to influence on the study outcomes. Second, patient satisfaction was only measured in the PSA group, and only one day postoperatively without a standardized measurement scale. Similarly, pain was questioned in both groups, but again this data was not collected on a standardized scale. To properly monitor and compare pain and satisfaction, this should be measured more often and with valid measurement instruments in the future. Finally, our new approach is not directly generalizable as the use and role of physician assistants is very different both within and outside of the Netherlands. Physician assistants were introduced around 2000 in the Netherlands following a model of the United States of America. In the

last two decades, physician assistants are playing an increasing part in 'appropriate care' as they are trained to take over standardized tasks from the specialists. Physician assistants may thus increase the quality of care and patient satisfaction, while decreasing healthcare costs[9].

## Conclusion

In conclusion, our study shows that minor orthopedic surgery, such as removal of hardware or percutaneous Achilles' tendon lengthening, performed by PAs using PSA is safe and leads to almost halved admission time. In times of long waiting lists and increasing pressure on our healthcare systems, this is a promising development. Future studies could focus on the cost-effectiveness of this new approach, perhaps even alongside a randomized controlled trial to further support our findings and compare pain and satisfaction between PSA patients and inpatient controls.

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