



Summary

Background: The use of opioid analgesic drugs (OADs) to treat postoperative pain after sports traumatology procedures at the time of discharge may be associated with prolonged OAD use after discharge.

Material and methods: Between January and February 2017, 195 patients underwent inpatient surgery in a sports traumatology department. In total, 194 patients were available for retrospective analysis. The use of OAD and patient- and therapy-related factors were recorded. Odds ratios (OR; 95% CI) were calculated to detect potential risk factors of OAD use at the time of patient discharge.

Results: Overall, 50 patients (25.8%) received OADs as continuous medication, 85 patients (43.8%) received OADs as oral demand medication, and 103 patients (53.1%) received OADs as intravenous on-demand medication. Within the entire study population, 40 patients (20.6%) received OADs at the time of discharge. A high patient age (OR 1.04; 1.01–1.06), female gender (OR 2.19; 1.08–4.46), a long hospital stay (OR 1.44; 1.19–1.74), the use of regional and/or spinal anaesthesia (OR 3.18; 1.32–7.64) and the preoperative use of OADs (OR 27.0; 3.15–231.65) were found to increase patient risk of being discharged with OADs.

Conclusions: In sports traumatology, high patient age, female gender, long hospital stays and the preoperative use of OADs are risk factors for OAD use at the time of discharge. Physicians should be aware of these risk factors of administering prolonged OAD treatment, and they should try to terminate the use of OAD therapy or switch to non-opiate analgesics before discharging patients.

Keywords

Opioid crisis – Opioid epidemic – Sports traumatology – Arthroscopy – Oxycodone

ORIGINAL PAPER

Risk factors for opioid analgesic drug use at discharge after sports traumatology procedure

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Introduction

The United States is facing an opioid abuse epidemic with an increase in opioid-related deaths [17]. The prescription of opioid analgesic drugs (OADs) by healthcare professionals for therapeutic use significantly contributes to this epidemic. In the United States, about 20% of people who take OADs for non-medical reasons receive it through prescriptions from doctors [12]. Further, four out of five heroin users report that their abuse began with the prescription of opioid analgesics [7,15].

OADs have been established as effective tools in the treatment of postoperative pain, in both inpatient and outpatient settings. Thereby, healthcare professionals have difficult roles. On the one hand OADs are effective in the treatment of postoperative pain. On the other hand, the use of OADs carries the risk of the initiation of opioid addiction. The postoperative administration of OADs can lead to prolonged OAD use, especially when patients receive them at the time of discharge [3,10]. The opioid epidemic in the United States is now in the focus of orthopaedic surgeons, and various ways

to face the problem of the overuse of OADs have been evaluated [14,21]. Against this background, the evaluation of the role of OADs in postoperative pain treatment in the orthopaedic patient population in Europe is a relevant topic.

Purpose

The primary aim of this study was to evaluate the common practice regarding the use of OAD in the inpatient treatment of postoperative pain after sports traumatology surgery. Moreover, we analysed the OAD use during the hospital stay according to patient- and therapy-related factors to identify risk factors for OAD use at the time of discharge, which is associated with a prolonged OAD use after discharge [3,10].

Material and methods

Study population

The medical reports of all 195 patients who were hospitalized and underwent sports traumatological surgery at the traumatology department of our hospital between January and February of 2017 were

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Risikofaktoren für die Verwendung von Opiat-Analgetika bei Entlassung nach sporttraumatologischen Eingriffen – Behandlung von postoperativen Schmerzen vor dem Hintergrund der Opiat-Krise in den USA

Zusammenfassung

Hintergrund: Die Einnahme von Opiat-Analgetika zur Behandlung von postoperativen Schmerzen nach sporttraumatologischen Eingriffen zum Zeitpunkt der Entlassung kann mit einer verlängerten Opiat-Einnahme nach der Entlassung verbunden sein.

Material und Methoden: Zwischen Januar und Februar 2017 wurden 195 Patienten in einer sporttraumatologischen Abteilung stationär operiert. 194 Patienten standen für eine retrospektive Analyse zur Verfügung. Die Einnahme von Opiaten sowie patienten- und therapiebezogene Faktoren wurden erfasst. Odds ratios (OR; 95% CI) wurden berechnet, um potenzielle Risikofaktoren für eine Entlassung mit Opiat-Analgetika zu detektieren.

Ergebnisse: 50 Patienten (25,8%) erhielten Opiate als Basis-, 85 Patienten (43,8%) als orale Bedarfs- und 103 Patienten (53,1%) als intravenöse Bedarfsmedikamente. 40 Patienten (20,6%) erhielten zum Zeitpunkt der Entlassung ein Opiat. Ein höheres Patientenalter (OR 1.04; 1.01-1.06), weibliches Geschlecht (OR 2.19; 1.08-4.46), eine längere Verweildauer im Krankenhaus (OR 1.44; 1.19-1.74), die Anwendung von Regional- und/oder Spinalanästhesie (OR 3.18; 1.32-7.64) und die präoperative Einnahme von Opiaten (OR 27.0; 3.15-231.65) zeigten jeweils ein höheres Risiko, mit Opiaten entlassen zu werden.

Schlussfolgerung: In der Sporttraumatologie sind ein höheres Patientenalter, weibliches Geschlecht, ein längerer Krankenhausaufenthalt und die präoperative Einnahme von Opiaten Risikofaktoren für eine Opiat-Einnahme

revised retrospectively. Only the first hospital stay was included in the analysis if a patient had more than one operation within the study period. Due to incomplete data, one patient was excluded from data analysis. Thus, 194 patients were included in this analysis.

Patient-related and therapy-related factors

Patient age at the time of the operation, gender, body mass index (BMI), and American society of Anaesthesiologists (ASA) score, the preoperative use of psychotropic drugs, and nicotine abuse at the time of the operation were evaluated. The type of operation, duration of the operation and hospital stay length were registered for each patient. The duration of the operation was defined as the time between the start of the preparation of the patient for the operation and the completion of the application of the dressing. The kinds of anaesthesia that were used, including general, spinal and regional anaesthesia, were assessed.

OAD use during the hospital stay was evaluated if the patients received OADs after their operations as continuous, oral on-demand and/or intravenous on-demand medication. The specific drugs that were administered were also documented. Changes in the types of OADs that were administered to each patient were also assessed. In addition, we recorded, whether the patients received OADs at the time of discharge or not. Furthermore, we assessed the different OAD drugs, which were administered to the patients at discharge. None of the patients had a preoperative addiction to opioids.

Statistical analysis

Statistical analysis was performed using the JMP software package (JMP Version 12.2.0, SAS Institute Inc., Cary, NC, USA). The data was screened for normality of distribution using the Shapiro-Wilk-W test. Descriptive statistical analysis was carried out to calculate the medians and ranges. Odds ratios (OR; 95% CI) were calculated using univariate logistic regression to identify potential risk factors of OAD use at the time of discharge. Subgroup analyses including descriptive statistical analyses and univariate logistic regressions were performed regarding the types of surgeries that the patient received. A two-sided significance level of $\alpha \leq 0.05$ was used to determine statistical significance.

Ethical statement

The ethics committee of the University of Tuebingen approved this study (reference number 049/2018B02). This study was performed in accordance with the ethical standards of the Declaration of Helsinki from 1964. Informed consent was not obtained due to the retrospective design of the study.

Results

In total, 194 patients (median age 47 years, 67% males) were available for retrospective analysis.

During their hospital stays, 50 patients (25.8%) received OADs as continuous medication, 85 patients (43.8%) received OADs as oral on-demand medication, and 103 patients (53.1%) received OADs as intravenous on-demand medication. [Table 1](#) shows the specific OADs that were administered.

Within the entire study population, 40 patients (20.6%) received OADs at the time of discharge: 29 patients

zum Zeitpunkt der Entlassung. Der behandelnde Arzt sollte diesen Patientengruppen besondere Aufmerksamkeit schenken und nach Möglichkeit versuchen, die Opiat-Therapie zu beenden oder vor der Entlassung auf Nicht-Opiat-Analgetika zu wechseln.

Schlüsselwörter

Opiatkrise– Opiatepidemie– Sporttraumatologie– Arthroskopie– Oxycodon

Table 1. OAD used as continuous as well as oral and intravenous on-demand medication within the complete study population ($n = 194$). PR – prolonged-release, IR – immediate-release.

OAD	Pat.	%
Continuous		
PR oxycodone/naloxone	13	26.0
PR oxycodone/naloxone + tramadol or PR tilidine/naloxone	14	28.0
PR tilidine/naloxone	18	36.0
Tramadol	5	10.0
<i>Total</i>	50	100.0
Oral on-demand		
IR oxycodone	68	80.0
PR oxycodone/naloxone	8	9.4
PR oxycodone/naloxone + IR oxycodone	8	9.4
Buprenorphine	1	1.0
<i>Total</i>	85	100.0
Intravenous on-demand		
Piritramide	103	100.0

took prolonged-release tilidine/naloxone, 7 took tramadol, and 4 took prolonged-release oxycodone/naloxone. All these patients received OADs as continuous medication during their hospital stays. As shown in Table 2, high patient age (OR 1.04; CI 1.01–1.06), female gender (OR 2.19; CI 1.08–4.46), long duration of a patient's hospital stay (OR 1.44; CI 1.19–1.74) and the use of regional and/or spinal anaesthesia (OR 3.18; CI 1.32–7.64) were found to be risk factors that make a patient likely to be discharged while on an OAD. Overall, 125 patients received some form of regional anaesthesia and 15 received spinal anaesthesia. In particular, the following treatments were administered: peripheral nerve catheter ($n = 91$), single-shot peripheral nerve block ($n = 19$), spinal anaesthesia ($n = 4$), spinal anaesthesia plus peripheral nerve catheter ($n = 10$) and spinal anaesthesia in combination with a peripheral nerve

catheter and a single-shot peripheral nerve block ($n = 1$).

Also, the preoperative use of OADs, which was identified in 7 patients, was associated with an increased risk of discharge while on an OAD (OR 27.0; CI 3.15–231.65). In total, 6 out of these 7 patients received an OAD as continuous medication and were also discharged while on an OAD. No influence was found for nicotine abuse or the duration of the operation. Further, 15 patients took psychotropic drugs prior to the operation. This was not found to significantly increase the risk of OAD use during the hospital stay or after discharge.

Stratifying for the type of surgical procedure, risk factors of OAD use at the time of discharge were analysed. Overall, 27 out of 135 patients who underwent arthroscopies of the knee, hip, ankle, or shoulder were discharged with OADs. The univariate logistic regression of the data about patients who received

Table 2. Results for the factors age, BMI, duration of the operation and the hospital stay (median (range)) as well as gender, regional and/or spinal anaesthesia, psychotropic drug use, nicotine abuse, and preoperative OAD use within the OAD positive and negative groups.

	Overall (n = 194)	Continuous medication		Oral on-demand medication		Intravenous on-demand medication		OAD at discharge		Odds ratio
		Yes (n = 50)	No (n = 144)	Yes (n = 85)	No (n = 109)	Yes (n = 103)	No (n = 91)	Yes (n = 40)	No (n = 154)	
Age [years]	47 (10–84)	52 (21–84)	42 (10–81)	49 (16–84)	45 (10–81)	45 (15–84)	49 (10–81)	54 (18–84)	42.5 (10–81)	1.04 (CI 1.01–1.06) p = 0.0017
Gender (male/ female)	130/64	25/25	105/39	54/31	76/33	64/39	66/25	21/19	109/45	2.19 (CI 1.08–4.46) p = 0.0317
BMI [kg/m ²]	27.2 (17.7–97.0)	26.75 (18.3–43.3)	27.3 (17.7–97.0)	26.2 (18.3–43.3)	28.0 (17.7–97.0)	27.5 (18.3–97.0)	26.5 (17.7–44.6)	27.1 (22.1–43.3)	27.2 (17.7–97.0)	0.99 (CI 0.95–1.04) n.s.
Duration oper- ation [minutes]	89.5 (16–260)	103 (16–167)	88 (20–260)	101 (26–200)	73 (16–260)	89 (26–260)	90 (16–233)	98 (16–167)	98 (20–260)	1.00 (CI 0.99–1.01) n.s.
Duration hospi- tal stay [days]	3 (1–14)	4 (2–14)	3 (1–8)	4 (1–12)	3 (1–14)	3 (1–14)	3 (1–9)	4 (2–12)	3 (1–14)	1.44 (CI 1.19–1.74) p = 0.0002
Regional and/or spinal anaes- thesia (yes/no)	125/69	41/9	84/60	72/13	53/56	64/39	61/30	33/7	92/62	3.18 (CI 1.32–7.64) p = 0.0051
Psychotropic drug (yes/no)	15/179	5/45	10/134	8/77	7/102	9/94	6/85	4/36	11/143	1.44 (CI 0.43–4.80) n.s.
Nicotine abuse (yes/no)	53/141	11/39	42/102	24/61	29/80	33/70	20/71	11/29	42/112	(CI 0.46–2.21) n.s.
Preoperative OAD use (yes/ no)	7/187	6/44	1/143	5/80	2/107	3/100	4/87	6/34	1/153	27.0 (CI 3.2–231.7) p = 0.0002

arthroscopies revealed that patients with relatively high ages (OR 1.03; CI 1.00–1.06; $p = 0.0158$), female gender (OR 2.53; CI 1.06–6.02; $p = 0.0372$) and relatively long hospital stays (OR 1.40; CI 1.11–1.76; $p = 0.0020$) were significantly more likely than others to be discharged with OADs. Because too few patients used OADs preoperatively, this factor could not be used for the subgroup analysis. No significantly higher risk of OAD use at the time of discharge was found in patients who underwent arthroscopies regarding BMI (OR 0.99; CI 0.93–1.05), nicotine abuse (OR 1.20; CI 0.47–3.05), regional and/or spinal anaesthesia (OR 1.90; CI 0.71–5.11), psychotropic drug use (OR 2.57; CI 0.58–11.53), and duration of the operation (OR 1.00; CI 0.99–1.01). Overall, 8 out of 20 (40.0%) patients with osteotomies around the knee were discharged with OADs. Table 3 shows the types of OADs that were administered during the patients' hospital stays and at their discharge times for different surgical procedures.

Discussion

Within our study population, the use of OADs was low as continuous and on-demand medication. However, 21% of our patients were discharged with OADs. We found that advanced age, female gender, a long hospital stay, the use of a regional and/or spinal anaesthesia, and preoperative OAD use are associated with increased risk of receiving OADs at the time of patient discharge from the hospital. Within the subgroup of arthroscopy patients, the factors of high age, female gender, and long hospital stay were found to be associated with increased risk of being discharged with OADs.

Table 3. Distribution of patients with and without OAD as continuous medication, oral and intravenous on-demand medication, and with and without OAD at the time of discharge for different surgical procedures.

Operation	Overall (<i>n</i> = 194)	Continuous medication		Oral on-demand medication		Intravenous on-demand medication		OAD use at discharge	
		Yes (<i>n</i> = 50)	No (<i>n</i> = 144)	Yes (<i>n</i> = 85)	No (<i>n</i> = 109)	Yes (<i>n</i> = 103)	No (<i>n</i> = 91)	Yes (<i>n</i> = 40)	No (<i>n</i> = 154)
Arthroscopy shoulder	46	15 (33%)	31 (67%)	31 (67%)	15 (33%)	25 (54%)	21 (46%)	13 (28%)	33 (72%)
Arthroscopy knee	71	14 (20%)	57 (80%)	28 (49%)	43 (61%)	41 (58%)	30 (42%)	12 (17%)	59 (83%)
Arthroscopy ankle	15	2 (13%)	13 (87%)	3 (20%)	12 (80%)	6 (40%)	9 (60%)	2 (13%)	13 (87%)
Arthroscopy hip	3	1 (33%)	2 (67%)	1 (33%)	2 (67%)	0	3 (100%)	0	3 (100%)
Osteotomy distal femur and/or proximal tibia	20	12 (60%)	8 (40%)	10 (50%)	10 (50%)	8 (40%)	12 (60%)	8 (40%)	12 (60%)
Shoulder arthroplasty	2	1 (50%)	1 (50%)	1 (50%)	1 (50%)	1 (50%)	1 (50%)	1 (50%)	1 (50%)
Spongiosaplasty of femoral/tibial drill holes	4	1 (25%)	3 (75%)	2 (50%)	2 (50%)	3 (75%)	1 (25%)	1 (25%)	3 (75%)
Hardware removal	24	2 (8%)	22 (92%)	3 (12.5%)	21 (87.5%)	11 (46%)	13 (54%)	2 (8%)	22 (92%)
Others	9	2 (22%)	7 (78%)	6 (67%)	3 (33%)	8 (89%)	1 (11%)	1 (11%)	8 (89%)

Several recently published studies are focused on the detection of the potential risk factors for prolonged OAD use after orthopaedic surgery. The major risk factor was found to be the preoperative use of OADs. This was confirmed in different patient populations, including patients who underwent knee arthroscopies [19], hip arthroscopies [1] and hip- or knee arthroplasties [2,11,22]. Ruder et al. evaluated patterns of OAD prescribing for an orthopaedic trauma population and defined preoperative OAD use as a risk factor [18]. Only 7 patients within our study population took OADs prior to the current operation, and 6 of them received OADs as continuous medication after their operations and were also discharged with OAD. We confirmed OAD use at the time of discharge as a risk factor and, therefore, agree with the results of current related literature.

Further risk factors for OAD abuse in the arthroplasty population were identified as young age, female gender and preoperative hypnotic drug use [11], as well as other diagnoses, including lower back pain, drug dependence, anxiety, depression, myalgia, alcohol dependence, and nicotine abuse [2]. Gangavalli et al. presented the results of a study of orthopaedic postoperative patients who underwent surgical fixations of fractures [8]. They found that unemployment and low income are associated with the use of prescribed OADs at higher-than-recommended doses and the use of extra OADs in addition to the prescribed analgesics. A review article about the OAD use after upper extremity surgery by Gauger et al. detected young age, a history of substance abuse, psychological disorders, and previous pain diagnoses as risk factors for prolonged postoperative OAD use [9].

Besides the detection of several other risk factors, the results that old age is a potential risk factor for OAD misuse after orthopaedic surgery are inconsistent. We detected advanced age as a risk factor for OAD use at discharge. The reason for this might be that the study populations differ due to epidemiological and therapeutic factors. Here, we present the results of a study with a purposive sampling that only contained patients with sports traumatology conditions. For example, the median age in our complete study population was 47 years, which is low compared to an average of 80 years in the above-mentioned arthroplasty study by Inacio et al. [11], as well as in the arthroplasty study by Bedard et al. [2] in which 97.3% of the study population was older than 50 years.

Within our study, the preoperative use of psychotropic drugs and nicotine abuse were identified to not be risk factors for being discharged with OADs. Therefore, we could not confirm the results of previous literature. Although the group of patients that received OADs at the time of discharge contained more smokers and patients who use psychotropic drugs, the difference compared to the group that did not receive OADs at the time of discharge was found to be insignificant. Recent studies showed that both of them are risk factors for persistent OAD use after surgery [10,20]. Further, Carroll et al. found that self-perceived risk of addiction and depressive symptoms could each be used independently to predict prolonged OAD use after surgery [4]. We identified duration of hospital stay as a risk factor that increases a patient's likelihood of receiving an OAD at the time of discharge after undergoing a sports traumatology procedure. This finding might be

influenced by different other factors. For example, relatively invasive procedures are associated with relatively high levels of postoperative pain and long hospital stays. We identified higher rates of OAD use during hospital stay and at the time of discharge among the osteotomy group than others.

Further, the perioperative use of regional and/or spinal anaesthesia was identified as a risk that increased the likelihood for patients in our study population to be discharged with OAD. Regional anaesthesia is widely used in our institution. The majority of patients in nearly every operation group received some kind of regional anaesthesia. These treatments might have been used in more invasive procedures that could be associated with a high OAD demand. Further, in the daily practice of our institution, patients who receive regional and/or spinal anaesthesia regularly receive OADs along with the spinal anaesthesia or as soon as the peripheral nerve catheter is removed. Insofar, there is a selection bias when it comes to the potential association between the use of regional and/or spinal anaesthesia and OAD, which makes the interpretation difficult. Nevertheless, there is evidence among postoperative patients, regional anaesthesia provides better analgesia compared to oral analgesics alone and that it can reduce the demand for OADs [5,13,16].

According to the literature, to prevent prolonged OAD use or addiction after surgery, it seems to be important to stop OAD treatment or switch to non-opioid analgesics during the hospital stay. Chaudhary et al. analysed the incidence and predictors of OAD prescription at the time of discharge after traumatic injury [6]. They found that old age, marriage, and a high injury severity score are

associated with an increased likelihood of OAD prescription at the time of discharge and male gender and high levels of anxiety are associated with a decreased likelihood thereof. Our results confirm these findings regarding age and gender.

Within our study population, only 25.8% of the patients received OADs as continuous medication. We used prolonged-release oxycodone/naloxone, prolonged-release tilidine/naloxone, and tramadol. Oral oxycodone is a step 3 OAD according to the pain ladder of the World Health Organization (WHO). Beside its analgesic effect, oxycodone causes euphoria, which leads to the risk of its misuse and addiction. For oral on-demand OAD, we used immediate-release oxycodone in the majority of cases in addition to continuous analgesic therapy. Prolonged-release oxycodone/naloxone was only used as oral on-demand OAD in some cases and especially for pain treatment after shoulder arthroscopy. Patients with a regional anaesthesia technique received prolonged-release oxycodone/naloxone once on-demand at the time of their first postoperative pain. As intravenous on-demand OAD, Piritramide was particularly given in the early postoperative period. Prolonged-release tilidine/naloxone and tramadol are step 2 analgesic drugs according to the WHO pain ladder. During each patient's hospital stay, treatment with prolonged-release oxycodone/naloxone was neither switched to prolonged-release tilidine/naloxone or tramadol if OAD therapy was still necessary. Otherwise, opioid therapy was completely ceased in the majority of cases. Only 4 patients within the study population received prolonged-release oxycodone/naloxone at the time of discharge.

Conclusion

Among the sports traumatology population in this study, 21% of the patients were discharged with OAD. High patient age, female gender, a long hospital stay, and the preoperative use of OADs were found to be risk factors for OAD use at the time of discharge also in less invasive procedures like arthroscopies. The treating physician should try to stop OAD therapy or switching to non-opioid-analgesics before discharging a patient who has received OADs. If this is not possible, the close collaboration with the patient's local physician is necessary to focus on the reduction of OAD use in the outward postoperative period to prevent prolonged OAD use.

Conflict of interest

The authors declare that they have no conflicts of interest.

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