

Marquette University

e-Publications@Marquette

School of Dentistry Faculty Research and
Publications

Dentistry, School of

5-2018

Quality of Postoperative Pain Management After Maxillofacial Fracture Repair

Andre Peisker

Winfried Meissner

Gregor F. Raschke

Mina D. Fahmy

Arndt Guentsch

See next page for additional authors

Follow this and additional works at: https://epublications.marquette.edu/dentistry_fac



Part of the [Dentistry Commons](#)

Authors

Andre Peisker, Winfried Meissner, Gregor F. Raschke, Mina D. Fahmy, Arndt Guentsch, Juliane Schiller, and Stefan Schultze-Mosgau

Marquette University

e-Publications@Marquette

Dentistry Faculty Research and Publications/School of Dentistry

This paper is NOT THE PUBLISHED VERSION.

Access the published version via the link in the citation below.

Journal of Craniofacial Surgery, Vol. 29, No. 3 (May 2018): 720-725. [DOI](#). This article is © Lippincott Williams & Wilkins, Inc. and permission has been granted for this version to appear in [e-Publications@Marquette](#). Lippincott Williams & Wilkins, Inc. does not grant permission for this article to be further copied/distributed or hosted elsewhere without the express permission from Lippincott Williams & Wilkins, Inc.

Quality of Postoperative Pain Management After Maxillofacial Fracture Repair

Andre Peisker

Department of Cranio-Maxillofacial & Plastic Surgery, Jena University Hospital, Jena, Germany

Winfried Meissner

Department of Anesthesiology and Intensive Care Medicine, Jena University Hospital, Jena, Germany;

Gregor F. Raschke

Department of Cranio-Maxillofacial & Plastic Surgery, Jena University Hospital, Jena, Germany

Mina D. Fahmy

Department of Surgical Sciences, School of Dentistry, Marquette University, Milwaukee, WI

Arndt Guentsch

Department of Surgical Sciences, School of Dentistry, Marquette University, Milwaukee, WI

Juliane Schiller

Department of Cranio-Maxillofacial & Plastic Surgery, Jena University Hospital, Jena, Germany

Stefan Schultze-Mosgau

Department of Cranio-Maxillofacial & Plastic Surgery, Jena University Hospital, Jena, Germany

Abstract

Background: Effective pain management is an essential component in the perioperative care of surgical patients. However, post-operative pain after maxillofacial fracture repair and its optimal therapy has not been described in detail.

Materials and Methods: In a prospective cohort study, 95 adults rated their pain on the first postoperative day after maxillofacial fracture repair using the questionnaire of the Quality Improvement in Postoperative Pain Management (QUIPS) project. Quality Improvement in Postoperative Pain Management allowed for a standardized assessment of patients' characteristics and pain-related parameters.

Results: Overall, the mean maximal pain and pain on activity (numeric rating scales) were significantly higher in patients with mandibular fractures than in patients with midface fractures ($P = 0.002$ and $P = 0.045$, respectively). In patients with mandibular fractures, a longer duration of surgery was significantly associated with higher satisfaction with pain intensity ($P = 0.015$), but was more frequently associated with postoperative vomiting ($P = 0.023$). A shorter duration of surgery and an absence of preoperative pain counseling in these patients were significantly correlated to desire for more pain medication ($P = 0.049$ and $P = 0.004$, respectively). Patients with mandibular fractures that received opioids in the recovery room had significantly higher strain-related pain ($P = 0.017$). In patients with midface fractures, a longer duration of surgery showed significantly higher levels of decreased mobility ($P = 0.003$). Patients receiving midazolam for premedication had significantly less minimal pain ($P = 0.021$).

Conclusions: Patients with mandibular fractures seem to have more postoperative pain than patients with midface fractures. Monitoring of postsurgical pain and a procedure-specific pain-treatment protocol should be performed in clinical routine.

Key Words:

Analgesia, mandibular fracture, midface fracture, postoperative care, postoperative pain

Maxillofacial fractures are commonly encountered in the practice of oral and maxillofacial surgery. Effective postoperative pain therapy is an essential component of the perioperative care of these patients. Effective management can reduce postoperative morbidity, hospital stay, and overall expenses.^{1,2} Because of the procedure-specific differences in analgesic efficacy, an evidence-based, procedure-specific guideline for perioperative pain management is required.¹ Unfortunately, there is a lack of literature regarding quality of pain management in the field of oral and maxillofacial surgery.³

In 2005, an outcome-oriented project called Quality Improvement in Postoperative Pain Treatment (QUIPS) was designed. This multicentric, interdisciplinary benchmark project allows for a standardized method of collection and an analysis of process and result parameters to investigate postoperative pain and its influence during patients' first day after surgery.⁴

In 2015, a prospective study using data of 85 patients after midface repair taking part in QUIPS registry has indicated that nearly a third of the patients showed inadequate postoperative pain management.³ The numbers of mandibular fractures are higher than midface fractures, confirming international findings.⁵⁻⁷ Thus, the additional data representing patients with mandibular fractures are of special interest for evaluation of the quality of postoperative pain management after maxillofacial fracture repairs.

The aim of this prospective clinical study was to analyze the postoperative pain within the first 24 hours in adults after mandibular and midface fracture repair, its pain management, and associated parameters using QUIPS data.

MATERIALS AND METHODS

This prospective cohort study was performed at the Department of Maxillofacial Surgery/Plastic Surgery of the University Hospital Jena and was part of the German-wide QUIPS registry. Quality Improvement in Postoperative Pain Treatment is registered at the German Clinical Trials Register (DRKS-ID: DRKS00006153). The local ethics committee of the Jena University Hospital approved the study. The patients gave their written informed consent. All questionnaires including the informed consent were recorded. Patients were excluded from the study, if they were <18 years, they had cognitive deficits, and/or they had polytrauma.

In sum, 95 patients who underwent surgical repair for fractures of the malar, maxillary, and zygoma bones, as well as fractures of orbital floor and fractures of mandible were included.

Surgical Approaches and Treatment

The surgical repair of fractures was performed under general anesthesia. Xylocaine (2%) with 1:100,000 epinephrine local anesthesia (mibe GmbH, Brehna, Germany) was injected in the area of incision during the intra- and/or extraoral approach. Local anesthesia was injected only subcutaneously in the area of the facial nerve branches to aid in hemostasis at the time of incision.⁸

Surgical approaches as well as repositioning of fractures and osteosynthesis were performed in a standardized manner. The lateral and centrolateral midface were operated on via a maxillary vestibular approach, the superolateral orbital rim via an upper eyelid, and the infraorbital rim and the floor of the orbit via a transconjunctival approach.^{8,9}

The mandibular vestibular approach was used to access the mandibular skeleton, from the mandibular ramus and posterior body region to the symphysis. The condylar neck and head was accessed via a retromandibular and preauricular approach. If greater exposure was required, these 2 approaches were connected, using a modified Blair incision.^{8,10}

In cases of fractures with malocclusion, a temporary mandibulo-maxillary fixation (MMF) via arch bars in the upper and lower jaw was required to reconstruct the occlusion.⁵

For osteosynthesis, mini-plates (Medartis, Basel, Switzerland) were applied and fixed with monocortical osteosynthetic screws. Only the infraorbital rim was stabilized with microplates (Medartis, Basel, Switzerland). If necessary, alloplastic reconstruction of the floor of the orbit was performed by using a polydioxanone sheet (PDS; Ethicon Products, Norderstedt, Germany), and in severe cases by a titanium mesh implant (Synthes, Umirch, Germany).^{5,9,11}

Premedication and Perioperative Pain Management

General anesthesia and perioperative pain treatment were performed according to hospital standards (premedication: midazolam; intraoperative analgesics: opioid and nonopioid; postoperative analgesics: nonopioid combined with opioid on an as-needed basis; local cool packs). Patients received granisetron and dexamethasone for prophylaxis of postoperative nausea and vomiting (PONV) according to their individual risk profile. Variations from this standard were allowed in cases of allergies, patients' preferences, and other reasons.

Assessment of Postoperative Pain

The QUIPS questionnaire is presented in detail elsewhere.⁴ The data obtained included age, sex, American Society of Anesthesiologists² status, and duration of surgery. The assessment of postoperative pain was performed in the afternoon of the first postoperative day (24–30 hours after surgery) by a study nurse who was not involved in the routine care of the patients.

After standardized instruction, the patients filled out the first part of the QUIPS questionnaire; 11-point numeric rating scales (NRS) were used. Generally, higher numbers indicate more pain (0 no pain; 10 maximal pain). In addition, dichotomous questions were answered with “yes” or “no.” The protocol is divided into sections dealing with average and worst pain intensities during the last 24 h since surgery (NRS 0–10); pain-related interference with physical activity (walking, movement); coughing and deep breathing, sleep, and mood during the last 24 h since surgery (NRS 0–10); pain-related awakening during the previous night; nausea or vomiting since surgery; wish to have had received additional doses of pain medication during the period since surgery; patient satisfaction with postoperative analgesia recorded using a 16-box NRS (0–15: 0, very unsatisfied; 15, very satisfied).

The second part, which was completed by a study nurse, included the relevant patient demographics and clinical parameters such as age, sex, type of surgery, anesthesia, and pain management. All data were made anonymous and transferred to the external database of QUIPS via Internet (<http://www.quips-projekt.de>).

Statistical Analysis

Statistical analyses were performed using IBM SPSS 23 for Windows (Chicago, IL). Outcome and process parameters are given descriptively. Data are presented as mean±SD if not otherwise indicated. Outcome and clinical parameters of all included patients are summarized descriptively. Nonparametric Mann–Whitney *U* tests were applied to compare continuous variables between resulting independent subgroup pairs. Furthermore, Mann–Whitney *U* test was used to compare the postoperative pain between mandibular and midfacial fractures. Pearson χ^2 tests were applied to compare categorized data of independent subgroups. In cases where requirements for Pearson χ^2 test were not met, Fisher exact test was used. In general, nominal *P* values of 2-tailed tests are reported. Levels of statistical significance have been calculated at the 5% level of probability ($P < 0.05$).

RESULTS

Patients

The patient demographic data are presented in Table 1. A total of 95 patients were enrolled in this analysis, including 19 (20%) cases of mandibular fractures and 76 (80%) cases of midfacial fractures. Among the patients with mandible fracture, 13 (68%) were males and 6 (32%) were females. The mean age was 42.3 ± 20.1 years (mean±SD). Seven (37%) patients were classified under ASA 1, 10 (53%) under ASA 2, and 2 (11%) under ASA 3. Eight (42%) patients showed a fracture of the condylar process, 5 (26%) a ramus fracture, 4 (21%) a fracture of the mandibular body, and 2 (11%) multiple fracture sites. Mean duration of surgery was 161.8 ± 67.7 minutes (median time = 152 minutes).

Among the 76 patients with midfacial fractures, 52 (68%) were males and 24 (32%) were females. The mean age was 55.1 ± 20.4 years. Thirty-two (42%) patients were classified under ASA 1, 37 (49%) ASA 2, and 7 (9%) ASA 3. Fifty-three (70%) patients had a lateral midfacial fracture, 15 (20%) an isolated orbital floor fracture, 5 (7%) a centrolateral midfacial fracture, and 3 (4%) a central midfacial fracture. Mean duration of surgery was 87.3 ± 79.4 min- minutes (median time = 84 minutes).

Quality Improvement in Postoperative Pain Management: Process Parameter

Mandibular fracture repair revealed the highest pain scores on the 11-step NRS (maximal pain: 5.4 ± 2.4 [mean±SD]; minimal pain: 1.8 ± 1.7 ; pain on activity: 4.0 ± 2.4) compared with midface fracture repair (maximal pain: 3.4 ± 2.2 ; minimal pain: 1.1 ± 1.2 ; pain on activity: 2.9 ± 2.0). There was a significant difference between both fracture type for maximal pain and pain on activity ($P 0.002$ and $P 0.045$, respectively). The frequency of

patients with maximal pain scores ≥ 4 was 63% (n 12) for mandibular fracture repair and 29% (n = 22) for midface fracture repair.

TABLE 1. Demographic Data of Patients

	Type of Fracture (n%95)	
Characteristics	Mandibular Fracture	Midfacial Fracture
Age (mean \pm SD)	42.3 \pm 20.1	55.1 \pm 20.4
Sex		
Male 13 (68%)		52 (68%)
Female	6 (32%)	24 (32%)
ASA (I–VI)		
I	7 (37%)	32 (42%)
II	10 (53%)	37 (49%)
III	2 (11%)	7 (9%)

TABLE 2. Relation Between Process and Outcome Parameters Concerning Postoperative Pain After Mandible Fracture Repair (Part 1)

Measure	Pain on Activity	Maximum Pain Intensity	Minimum Pain Intensity	Satisfaction With Pain Intensity	Mobility Decreased	Breathing Disturbance
Age (median = 40 y)	0.542	0.969	0.933	0.700	0.622	0.395
Sex	0.765	0.701	0.244	0.467	0.017	1.000
Male (n = 13)					n = 1	
Female (n = 6)					n = 4	
ASA (I vs II–III)	0.167	0.482	0.083	0.261	0.603	1.000
Duration of surgery (median time = 152 min)	0.241	0.065	0.208	0.015	0.754	0.968
>Median (n = 10)				9.3 \pm 1.0		
<Median (n = 9)				6.4 \pm 2.6		
Pain management counseling	0.765	0.21	0.416	0.21	1.000	1.000
Premedication midazolam	0.127	0.058	0.323	0.467	0.262	1.000
Sufentanil intraoperative	0.65	0.482	0.536	0.712	1.000	0.377
Remifentanil intraoperative	0.958	0.875	0.421	0.712	1.000	0.058
Piritramid	0.657	0.281	0.585	0.316	1.000	1.000
Nonopioid intraoperative	0.634	0.875	0.793	0.818	1.000	0.546
Clonidine perioperative	0.749	0.947	1.000	0.842	1.000	1.000
PONV prophylaxis						
Granisetron	0.004	0.004	0.138	0.085	0.228	0.517
Yes (n = 16)	4.6 \pm 2.2	6.1 \pm 2.0				
No (n = 3)	1.0 \pm 1.0	1.6 \pm 1.1				
Opioid in recovery room	0.017	0.227	0.227	0.068	0.305	0.740
Yes (n = 7)	5.7 \pm 2.2					
No (n = 12)	3.1 \pm 2.0					
Nonopioid in recovery room	0.545	0.788	0.408	0.633	1.000	1.000
Analgetics on ward	0.857	0.56	0.927	0.533	0.118	0.664
Nonopioid (n = 10)	4.1 \pm 2.5	5.9 \pm 2.2	2.0 \pm 2.1	8.5 \pm 1.2		
Nonopioid + weak opioid (n = 8)	4.1 \pm 2.5	5.1 \pm 2.8	1.75 \pm 1.3	7.0 \pm 3.2		

Bold values are statistically significant.

In all, satisfaction with pain intensity was moderate to high (mandibular fracture: 7.9 \pm 2.3; midface fracture: 9.0 \pm 1.9). The main negative effect reported as a consequence of postoperative pain was impaired breathing (42%)

in patients with mandibular fractures and mood impairment (29%) in patients with midface fractures. The most frequent pain therapy side effect was drowsiness in both groups (53% and 40%, respectively).

More than 68% of patients with mandibular fracture and 66% of the patients with midface fractures reported to have received preoperative pain counseling. Twenty-one percent of patients with mandibular fractures and only 3% of the patients with midface fractures expressed desire for more pain medication.

The premedication sedative was midazolam in the majority of cases (mandibular fracture = 68%; midface fracture = 82%). During surgery, 84% of the patients with mandibular fracture received opioids and metamizole. In patients with midface fractures, nearly half of the patients received opioids and 76% received metamizole. Clonidine was rarely used in both groups (<6%). Postoperative nausea and vomiting prophylaxis was performed in 8 of 10 patients with mandibular fractures and in half of the patients with midface fractures. Granisetron was the most frequently used drug for PONV in both groups.

In the recovery room, 7 (37%) patients with mandibular fractures and 15 (20%) patients with midface fractures received opioids. In addition, Parecoxib was the most frequently used nonopioid (mandibular fracture = 11%; midface fracture = 3%).

Back on ward, 53% of patients with mandibular fractures received metamizole alone and 42% a combination of metamizole with tramadol. In patients with midface fracture, a nonopioid (metamizole or ibuprofen) alone was given in 45% of patients and 28% received both nonopioid and opioid (metamizole or ibuprofen with tramadol).

All patients with mandibular fractures and nearly all patients with midface fractures (95%) received cold packs as physical pain therapy. A documentation of patient's pain in the chart was found in 90% of patients with mandibular and 97% of patients with midface fractures.

Relations Between the Outcome and Process Parameters After Mandibular Fracture Repair

Correlations between the outcome and process parameters after mandible fracture repair are shown in Tables 2 and 3.

Female patients showed significantly higher levels of decreased mobility ($P = 0.017$) compared with male patients. Duration of surgery above the calculated median of 152 min was related to significantly higher satisfaction with pain therapy ($P = 0.015$). However, a longer duration of surgery was more frequently associated with postoperative vomiting ($P = 0.023$). Patients receiving granisetron to prevent PONV presented with significantly higher levels of strain-related pain ($P = 0.004$) and higher maximal pain levels ($P = 0.004$). A shorter duration of surgery ($P = 0.049$) and an absence of preoperative pain counseling ($P = 0.004$) were correlated with a desire for more pain medication. Patients that received opioids in the recovery room presented with significantly higher levels of strain-related pain ($P = 0.017$).

Relationships between the outcome and process parameters after midfacial fracture repair are listed in Tables 4 and 5.

Significantly higher levels of decreased mobility ($P = 0.003$) were observed with surgeries of longer duration. Patients receiving midazolam for premedication showed significantly less minimal pain ($P = 0.021$). Significantly higher levels of mood disturbance were seen in younger patients ($P = 0.018$).

TABLE 3. Relation Between Process and Outcome Parameters Concerning Postoperative Pain After Mandible Fracture Repair (Part 2)

Measure	Sleeping Impairment	Mood Disturbance	Drowsiness	Nausea	Vomiting	Dizziness	Desire for More Pain Medication
Age (median = 40 y)	0.127	0.299	0.72	0.961	0.292	0.823	0.961
Sex	1.000	0.129	0.141	0.071	0.088	1.000	0.557
ASA (I vs II–III)	1.000	1.000	0.35	1.000	0.509	0.603	1.000
Duration of surgery	0.127	0.711	0.968	0.655	0.023	0.687	0.049
					Yes = 2; 274 ± 60.1 min		Yes = 4; 110 ± 22.8 min
					No = 17; 148 ± 56.3 min		No = 15; 175 ± 69.5 min
Pain management counseling	1.000	0.129	1.000	0.557	1.000	0.262	0.004
Yes = 13							n = 0
No = 6							n = 4
Premedication midazolam	0.32	0.617	0.141	0.557	1.000	0.262	0.577
Sufentanil intraoperative	1.000	0.656	1.000	1.000	1.000	0.305	0.603
Remifentanil intraoperative	0.517	0.523	1.000	0.53	0.298	0.155	1.000
Piritramid	1.000	0.368	1.000	1.000	1.000	1.000	1.000
Nonopioid intraoperative	0.222	1.000	0.582	0.53	1.000	1.000	0.53
Clonidine perioperative	1.000	0.368	1.000	1.000	1.000	0.263	1.000
PONV prophylaxis	0.263	0.087	1.000	1.000	1.000	0.53	1.000
Opioid in recovery room	1.000	0.656	0.35	0.117	0.123	0.305	0.603
Nonopioid in recovery room	1.000	1.000	1.000	1.000	1.000	1.000	1.000
Analgetics on ward	0.152	1.000	0.637	0.275	0.183	0.608	0.275
Nonopioid (n = 10)							
Nonopioid + weak opioid (n = 8)							

Bold values are statistically significant.

TABLE 4. Relation Between Process and Outcome Parameters Concerning Postoperative Pain After Midfacial Fracture Repair (Part 1)

Measure	Pain on Activity	Maximum Pain Intensity	Minimum Pain Intensity	Satisfaction With Pain Intensity	Mobility Decreased	Breathing Disturbance
Age (median = 58 y)	0.717	0.120	0.639	0.193	0.867	0.799
Sex	0.148	0.656	0.639	0.65	1.000	0.364
ASA (I vs II–III)	0.643	0.438	0.873	0.514	0.766	0.572
Duration of surgery	0.707	0.227	0.235	0.615	0.003	0.995
					Yes = 14; 138 ± 88 min	

					No = 62; 76 ± 73.5 min	
Pain management counseling	0.066	0.377	0.111	0.051	0.12	0.555
Premedication midazolam	0.072	0.064	0.021	0.816	0.714	0.156
Yes (n = 63)			1.0 ± 1.1			
No (n = 13)			1.8 ± 1.6			
Sufentanil intraoperative	0.119	0.184	0.339	0.773	1.000	0.545
Remifentanil intraoperative	0.341	0.726	0.12	0.625	0.635	0.672
Piritramid	0.776	0.855	0.871	0.468	1.000	1.000
Nonopioid intraoperative	0.795	0.858	0.858	0.123	0.497	0.187
Clonidine perioperative	0.271	0.991	0.762	0.779	0.565	0.576
PONV prophylaxis	0.912	0.732	0.71	0.172	0.774	0.782
Opioid in recovery room	0.371	0.053	0.779	0.625	0.276	1.000
Nonopioid in recovery room	0.34	0.387	0.961	0.789	1.000	0.379
Analgetics on ward	1.000	0.302	0.582	0.673	0.104	0.745
Nonopioid (n = 34)	3.0 ± 1.9	4.0 ± 2.1	1.4 ± 1.5	8.7 ± 2.1		
Nonopioid + weak opioid (n = 21)	3.2 ± 2.2	3.6 ± 2.4	1.0 ± 1.0	8.8 ± 2.1		

Bold values are statistically significant.

TABLE 5. Relation Between Process and Outcome Parameters Concerning Postoperative Pain After Midfacial Fracture Repair (Part 2)

Measure	Sleeping Impairment	Mood Disturbance	Drowsiness	Nausea	Vomiting	Dizziness	Desire for More Pain Medication
Age (median = 58 y)	0.217	0.018	0.331	0.317	0.485	0.161	0.57
		Yes = 22; 54.2 ± 21.8					
		No = 54; 55.3 ± 20.3					
Sex	0.207	0.287	0.46	0.09	0.097	1.000	0.535
ASA (I vs II–III)	0.061	0.10	0.635	1.000	1.000	1.000	0.506
Duration of surgery	0.858	0.218	0.126	0.136	0.101	0.271	0.897
Pain management counseling	1.000	0.068	0.327	0.292	0.544	1.000	0.114
Premedication midazolam	1.000	0.531	0.772	0.565	0.336	0.415	0.336
Sufentanil intraoperative	0.743	1.000	0.799	1.000	1.000	0.292	0.516
Remifentanil intraoperative	1.000	0.219	0.252	0.365	0.201	0.085	1.000
Piritramid	1.000	0.623	1.000	1.000	1.000	1.000	1.000
Nonopioid intraoperative	0.172	1.000	1.000	0.236	0.054	0.716	1.000
Clonidine perioperative	0.133	0.575	0.645	1.000	1.000	0.472	1.000

PONV prophylaxis	0.36	1.000	1.000	0.62	1.000	0.208	1.000
Opioid in recovery room	1.000	1.000	0.384	1.000	1.000	1.000	0.336
Nonopioid in recovery room	0.315	0.498	0.153	1.000	1.000	0.27	1.000
Analgetics on ward	1.000	1.000	1.000	0.519	0.519	0.188	1.000
Nonopioid (n = 34)							
Nonopioid þ weak opioid (n = 21)							

Bold values are statistically significant.

DISCUSSION

The control of pain is a neglected outcome in clinical trials of maxillofacial fractures. Furthermore, most studies did not describe the specific analgesics used.^{3,12} In the present study, we evaluated the quality of acute postoperative pain management after maxillofacial fracture repair using QUIPS. In other disciplines of surgery, QUIPS has already shown that outcomes of postoperative pain management can be measured and compared in routine clinical practice and may lead to improved perioperative care. The lowest mean score for the outcome measure “maximum pain intensity since surgery” was reported by patients who had received surgical procedures in gynecology and urology. In contrast, the highest mean score was reported by patients who had received surgical procedures in orthopedics and traumatology.^{4,13-15}

The main finding of this study was that patients with mandibular fractures seem to have more maximal pain ($P = 0.002$) and pain on activity ($P = 0.045$) within the first 24 hours after surgery than patients with midface fractures. In addition, 63% of the patients with mandibular fractures and 29% with midface fractures reported a maximal pain score NRS ≥ 4 . Based on the fact that NRS values exceeding levels of ≥ 4 indicate the necessity of pain therapy,¹⁶ we demonstrated how painful mandibular fracture repairs are. This could be explained by muscle attachments on the mandible that place dynamic vectors of force on the fracture.⁵ These patients would have perhaps benefited from additional pain medications. Compared with earlier reported pain levels after midface fracture repairs,³ patients in the present study indicated pain which was nearly similar. In patients with mandibular fractures, female sex seems to be a significant independent risk factor for higher levels of decreased mobility ($P = 0.017$).

Regarding the investigated relationship between process and outcome parameters, duration of surgery presented a significant influence on satisfaction with pain intensity in patients with mandibular fractures. Patients exhibiting a duration of surgery above the median of 152 min showed significantly higher satisfaction with pain therapy ($P = 0.015$). Significantly higher levels of decreased mobility were observed in patients with midface fractures and a longer duration of surgery ($P = 0.003$). In contrast, a shorter duration of surgery ($P = 0.049$) was correlated to more desire for pain medication in patients with mandibular fractures. We speculate that longer operation times are usually associated with more complex and/or complicated fractures leading to a higher degree of surgical trauma and higher levels of decreased mobility. In addition, based on the supposition that these patients have a higher risk of intense postoperative pain, they could have received more analgesics intraoperatively in the recovery room and on ward compared with patients with simple fractures and shorter operation time.

Administration of granisetron to prevent PONV presented significantly higher levels of strain-related ($P = 0.004$) and higher maximal pain levels ($P = 0.004$) in patients with mandibular fracture. Granisetron has a lower incidence of negative side effects¹⁷ and there are no indications in the current literature regarding increased sensitivity to pain after using this drug. Owing to the abovementioned anesthesia, duration as a relevant risk factor for PONV, we assume that granisetron was most commonly used in cases of longer operation times. Longer duration of surgery is usually associated with more complicated fractures inducing higher levels of postoperative strain-related maximum pain.

Furthermore, the duration of surgery presented a significant influence on postoperative vomiting ($P = 0.023$) in patients with mandibular fractures. Postoperative nausea and vomiting is one of the most common complaints after surgery under general anesthesia.¹⁸ Although the pathogenesis of PONV is still largely unclear, one of the relevant risk factors is the duration of anesthesia. Each 30-minute increase in operative duration increases PONV risk by 60%.¹⁹

An absence of preoperative pain counseling was correlated to increased desire for pain medication in patients with mandibular fracture ($P = 0.004$). Preoperative pain counseling may reduce presurgical anxiety and expected pain and could decrease the patient's risk of pain catastrophizing. It is an independent and possibly neglected factor to reduce postoperative pain level.¹⁵

A significantly higher level of strain-related pain ($P = 0.017$) was seen in patients with mandibular fractures receiving opioids in the recovery room. Pain therapy with opioids was done on an as-needed basis, that is, those patients with higher pain levels requested (and received) more opioids than those with less pain levels in the recovery room. As previously described for patients with midface fractures,³ patients were asked for their maximum pain levels, when the effect of opioids in the recovery room (piritramide) had diminished. Thus, the need of opioids in the recovery room should lead to use of opioids in the ward to prevent significant increase of pain levels.

In the presented study, we observed significantly higher levels of mood disturbance in younger patients with midface fractures ($P = 0.018$). Based on the current literature, traumatic events can cause emotional and psychological harm.⁹

Of special interest were the significantly decreased levels of minimal pain ($P = 0.021$) in patients with midface fractures receiving midazolam for premedication. Midazolam serves as a very common choice for anxiolysis in patients before anesthesia.^{20,21} The interindividual metabolism of midazolam can vary greatly. Therefore, the elimination half-life may range between 1.5 and 2.5 hours.²² Steiner et al discuss how some patients receiving midazolam premedication before short surgical procedures had higher plasma levels of the drug at the end of the operation compared with the beginning of anesthesia.²¹ Because of the shorter duration of surgery in midface fractures compared with mandibular fractures, midazolam premedication could be associated with increased sedation in the postoperative period that may influence the postoperative pain intensity. This should be analyzed in further studies.

The presented study using QUIPS is not without limitations. The postoperative pain was evaluated only once and within the first 24 hours after surgery. Furthermore, course of postoperative pain after the first postoperative day was not assessed. In addition, the presented data only had a monocentric character. Therefore, conclusions on a general situation cannot be made. Furthermore, the participation at the QUIPS project could have been influenced by undiscovered biases. Participating hospitals may modify or improve their postoperative pain management in response to their awareness of being observed.

Nevertheless, QUIPS has been shown to be an effective tool for measuring postoperative pain after maxillofacial fracture repairs. It has the main advantage of documenting not only patients' pain but also side effects of pain therapy. Therefore, it will be helpful for reevaluation of the effectiveness of any new pain treatment protocol.

CONCLUSIONS

In conclusion, this prospective cohort study demonstrates that patients with mandibular fractures seem to have more pain within the first 24 hours after surgery than patients with midface fractures. Analysis of process and outcome parameters showed that in patients with mandibular fractures, duration of surgery seems to have a significant influence on satisfaction with pain intensity, desire for more pain medication, and vomiting. Monitoring of postsurgical pain and a procedure-specific pain-treatment protocol should be performed in clinical routine. Quality Improvement in Postoperative Pain Management has been shown to be an effective and practical instrument for measuring postoperative pain and pain-related parameters.

REFERENCES

1. Kehlet H, Wilkinson RC, Fischer HB, et al. PROSPECT: evidence- based, procedure-specific postoperative pain management. *Best Pract Res Clin Anaesthesiol* 2007;21:149–159
2. Savoia G, Alampi D, Amantea B, et al. Postoperative pain treatment SIAARTI Recommendations 2010. Short version. *Minerva Anesthesiol* 2010;76:657–667
3. Raschke GF, Peisker A, Rieger U, et al. Quality of postoperative pain management after midfacial fracture repair—an outcome-oriented study. *Clin Oral Investig* 2015;19:619–625
4. Meissner W, Mescha S, Rothaug J, et al. Quality improvement in postoperative pain management: results from the QUIPS project. *Dtsch Arztebl Int* 2008;105:865–870
5. Koshy JC, Feldman EM, Chike-Obi CJ, et al. Pearls of mandibular trauma management. *Semin Plast Surg* 2010;24:357–374
6. Manodh P, Prabhu Shankar D, Pradeep D, et al. Incidence and patterns of maxillofacial trauma-a retrospective analysis of 3611 patients—an update. *Oral Maxillofac Surg* 2016;20:377–383
7. Kruger E, Tennant M. Fractures of the mandible and maxilla: a 10-year analysis. *Australas Med J* 2016;9:17–24
8. Ellis E, Zide MF. *Surgical Approaches to the Facial Skeleton*. Philadelphia, PA: Lippincott Williams & Wilkins; 2006
9. Kuhnel TS, Reichert TE. Trauma of the midface. *GMS Curr Top Otorhinolaryngol Head Neck Surg* 2015;14:Doc06
10. Al-Kayat A, Bramley P. A modified pre-auricular approach to the temporomandibular joint and malar arch. *Br J Oral Surg* 1979;17: 91–103
11. Avashia YJ, Sastry A, Fan KL, et al. Materials used for reconstruction after orbital floor fracture. *J Craniofac Surg* 2012;23:1991–1997
12. Butts SC, Floyd E, Lai E, et al. Reporting of postoperative pain management protocols in randomized clinical trials of mandibular fracture repair: a systematic review. *JAMA Facial Plast Surg* 2015;17:440–448
13. Meissner W, Ullrich K, Zwacka S. Benchmarking as a tool of continuous quality improvement in postoperative pain management. *Eur J Anaesthesiol* 2006;23:142–148
14. Gerbershagen HJ, Aduckathil S, van Wijck AJ, et al. Pain intensity on the first day after surgery: a prospective cohort study comparing 179 surgical procedures. *Anesthesiology* 2013;118:934–944
15. Guntinas-Lichius O, Volk GF, Zaslansky R, et al. The first postoperative day: prospective evaluation of pain in adult otorhinolaryngologic surgery. *Clin J Pain* 2014;30:978–986
16. Mantha S, Thisted R, Foss J, et al. A proposal to use confidence intervals for visual analog scale data for pain measurement to determine clinical significance. *Anesth Analg* 1993;77:1041–1047
17. Fujii Y, Toyooka H, Tanaka H. Oral granisetron prevents postoperative vomiting in children. *Br J Anaesth* 1998;81:390–392
18. Apfel CC, Laara E, Koivuranta M, et al. A simplified risk score for predicting postoperative nausea and vomiting: conclusions from cross- validations between two centers. *Anesthesiology* 1999;91:693–700
19. Rusch D, Eberhart LH, Wallenborn J, et al. Nausea and vomiting after surgery under general anesthesia: an evidence-based review concerning risk assessment, prevention, and treatment. *Dtsch Arztebl Int* 2010;107:733–741
20. Brosius KK, Bannister CF. Oral midazolam premedication in preadolescents and adolescents. *Anesth Analg* 2002;94:31–36
21. Steiner C, Steurer MP, Mueller D, et al. Midazolam plasma concentration after anesthesia premedication in clinical routine—an observational study: midazolam plasma concentration after anesthesia premedication. *BMC Anesthesiol* 2016;16:105

22. Wu CL, Berenholtz SM, Pronovost PJ, et al. Systematic review and analysis of postdischarge symptoms after outpatient surgery. *Anesthesiology* 2002;96:994–1003