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Abstract

Objectives

Postoperative pain management is of utmost interest for patients undergoing orthognathic surgery. Currently, there is a lack of information regarding process and outcome parameters of postoperative pain management after bilateral sagittal split osteotomy.

Materials and methods

In a prospective clinical study, 31 adults were evaluated on the first postoperative day following bilateral sagittal split osteotomy using the standardized questionnaire of the Germany-wide project Quality Improvement in Postoperative Pain Management (QUIPS). It allows a standardized assessment of patients' characteristics, pain parameters, outcome, and pain therapy process parameters.

Results

Pain management consisted mainly of premedication with midazolam, sufentanil, and metamizol intraoperatively; piritramide in the recovery room; and metamizol and tramadol on ward. Twenty patients (64.5%) showed inadequate pain management with pain levels ≥4. Patients receiving tramadol as opioid on ward presented significantly higher maximum pain levels ($p = .037$). Significantly lower satisfaction with postoperative pain intensity ($p > .001$) and significantly higher desire for additional pain medication ($p = .023$) were detected, when duration of surgery was above the median of 107.5 min.

Conclusions

Inadequate pain management on the first postoperative day following bilateral sagittal split osteotomy was widespread on our ward. QUIPS helped us to identify it and thereby gave us the possibility to improve the situation. Prolonged duration of surgery seems to be a predictor of an elevated postoperative pain medication demand.

Clinical relevance

Only the establishment of an ongoing monitoring of postoperative pain management can help to reduce or even avoid inadequate postoperative pain management. In accordance to the existing literature, we found inadequate postoperative pain management more widespread than thought.

Introduction

Postoperative pain is an inevitable consequence of surgery; nevertheless, reduction of postoperative pain should be an ethical obligation and commitment [1]. By reducing postoperative pain through sufficient postoperative pain therapy, not only postoperative morbidity is reduced significantly, but also less complications and costs can be achieved, as well as an abbreviated hospital stay [2, 3].

Unfortunately, it seems that inadequate postoperative pain management is widely prevalent [4–7]. Investigations from various countries showed that the quality of acute postoperative pain management is generally unsatisfying [8].

To improve this situation, several general clinical guidelines with quality indicators were published. Their aim was to help surgeons to establish a consistent, adequate, and modern postoperative pain therapy [9].

Meanwhile, it could be shown that acute postoperative pain management is most effective, when particular characteristics of pain are associated with particular surgical procedures, because the analgetic efficacy varies widely between different procedures [10].

Bilateral sagittal split osteotomies (BSSOs) are frequently performed surgical procedures in cranio-maxillofacial surgery. Regarding the previously mentioned guidelines for postoperative pain therapy, BSSOs belong to the section of head and neck surgery [11]. Head and neck surgery covers a wide field of highly varying operative procedures. Hence, postoperative pain management guidelines are not specific for pain management after BSSO, which though would be of specific interest to cranio-maxillofacial surgeons.

In the presented prospective clinical study, we performed a standardized assessment of patients' characteristics, pain parameters, outcome, and process parameters by using the standardized questionnaire of the Quality Improvement in Postoperative Pain Management (QUIPS) project. It allows standardized data acquisition and analysis of process and result parameters to investigate postoperative pain and its influencing parameters on the first postoperative day [12].

Patients and methods

The presented prospective study was performed at the Department of Cranio-Maxillofacial Surgery/Plastic Surgery of the University Hospital Jena. The local ethics committee of the Medical Faculty of the University Hospital Jena gave its institutional review board approval prior to the start of this study. All patients willing to participate were enrolled after signing informed consent.

All patients included in this study showed a skeletal class II or III malocclusion. They all exhibited a bilateral dentition of at least first molar to first molar. They all underwent orthodontics and orthognathic surgery, but no genioplasty or rhinoplasty and showed no congenital deformities, such as cleft lip and/or palate. After presurgical orthodontic treatment, the postoperative position of the mandible was planned on dental casts and cephalograms, so that maximum intercuspidation, adequate overbite, and a harmonious profile were achievable during surgery. BSSO was performed in a standardized manner [13, 14]. On the first postoperative day's morning, mandibulomaxillary fixation was initiated with elastics.

A study nurse, not being involved in the routine care of the patient, performed the assessment of postoperative pain on the first postoperative day, not exceeding 24 h after surgery.

After standardized instruction, the patient himself completed the first part of the QUIPS questionnaire covering outcome parameters of postoperative pain management:

- Average and worst pain intensities during the last 24 h since surgery (Numeric Rating Scale (NRS) 0–10, 0 = no pain, 10 highest imaginable pain level)
- Pain-related interference with physical activity (walking/movement), coughing and deep breathing, sleep, and mood over the last 24 h since surgery (NRS 0–10)
- Pain-related awakening during the previous night
- Nausea or vomiting since surgery
- Wish to have received additional doses of pain medication during the period since surgery
- Patient satisfaction with postoperative analgesia record using a 16-box NRS (0–15, 0 = very unsatisfied, 15 = very satisfied)

The second part of the questionnaire is covering the relevant patients' characteristics including, e.g., age, gender, body mass index (BMI), ASA status, and duration of surgery. Furthermore, it serves to record the relevant process parameters of postoperative pain management. This part was filled out by the aforementioned study nurse. All data were anonymized and transferred to the external database of QUIPS via the Internet (http://www.quips-projekt.de).

Statistical analysis

Data are presented as mean and standard deviation if not indicated otherwise. Outcome and process parameters are given descriptively (Tables 1 and 2). The continuous variables, age, and duration of surgery were transformed into dichotomous variables using the median values as separator. The non-parametric Mann-Whitney U test was applied to compare continuous variables between the resulting independent subgroup pairs, and the Kruskal-Wallis test was performed to compare results between multiple subgroups. The Pearson's chi-squared test was applied to compare categorized data of independent subgroups (see Tables 3 and 4). In cases where requirements for Pearson's chi-squared test were not met, the Fisher's exact test was applied. In cases where multiple groups were compared, nominal p values of two-tailed tests are reported. A p value of <0.05 was taken as significant.

Table 1 QUIPS outcome parameters after bilateral sagittal split osteotomy (n = 31 patients)

Pain on ambulation	4.06 ± 2.29
Maximum pain intensity	5.39 ± 2.50
Minimum pain intensity	2.06 ± 1.84
Satisfaction with pain intensity	11.58 ± 2.49
Preoperative pain management counseling	
Yes, only general	24
Yes, also specific	3
No	4
Chronic pain before surgery	
Yes	6
No	25
Mobility impairment because of pain	
Yes	17
No	14
Breathing impairment because of pain	
Yes	12
No	19
Sleeping impairment because of pain	
Yes	15
No	16
Mood impairment because of pain	
Yes	14
No	17
Desire for pain medication	
Yes	11
No	20
Drowsiness since surgery	
Yes	25
No	6
Nausea since surgery	
Yes	14
No	17

Vomiting since surgery	
Yes	6
No	25

Table 2 QUIPS process parameter after bilateral sagittal split osteotomy (*n* = 31 patients)

Sedative as premedication	
Midazolam	31
No	0
Non opioid intraoperative	31
Metamizole	31
No	0
Opioid intraoperative	31
Sufentanil	31
Remifentanil	6
Piritramide	3
No	0
Prednisolone	
Yes	20
No	11
PONV prophylaxis	29
Granisetron	24
Dexamethasone	16
No	2
Clonidine perioperatively	
Yes	0
No	31
Non-opioid in recovery room	0
Opioid in recovery room	12
Piritramide	12
No	19
Non-opioid on ward	31
Metamizole	29
Ibuprofen	5

No	0
Opioid on ward	12
Piritramide	0
Tramadol	12
No	19
Physical pain therapy on ward	
Cold pack	31
No	0
Individual pain therapy instruction on ward available	
Yes	31
No	0
Pain documentation in patient chart	
Yes	29
No	2

Table 3 Relation between process and outcome parameters concerning postoperative pain after bilateral sagittal split osteotomy (part 1)

	Pain on ambulation (0–10)	Maximum pain intensity (0–10)	Minimum pain intensity (0–10)	Satisfaction with pain intensity (0–15)	Mobility decreased (n)	Breathing disturbance (n)
Gender	0.417	0.789	0.271	0.319	0.717	0.489
Age (median = 35)	0.747	0.899	0.469	0.316	0.285	0.066
Weight (median in kg = 70)	0.047	0.151	0.149	0.161	1.00	1.00
ASA (I vs. II)	0.228	0.751	0.548	0.141	0.057	1.00
Duration of surgery (median in min = 105)	0.098	0.073	0.518	>0.001	0.473	0.724
<Median (n = 17)				1.131 ± 12.82		
>Median (n = 14)				2.487 ± 11.58		
Counseling (specific vs. general vs. no)	0.273	0.544	0.592	0.685	0.575	1.00
PONV prophylaxis	0.219	0.6	0.488	0.353	0.488	0.51
Granisetron	0.752	0.568	0.501	0.881	0.412	0.201
Dexamethasone	0.009	0.124	0.386	0.028	0.479	1.00
Yes (n = 16)	6.06 ± 1.806			10.63 ± 2.986		
No (n = 15)	4.67 ± 2.968			12.60 ± 1.242		

Prednisolone	0.242	0.645	0.364	0.764	1.00	1.00
Opioid in recovery room	0.27	0.074	0.462	0.233	0.724	0.452
Opioid on ward	0.348	0.037	0.65	0.133	0.724	0.452
Yes (n = 12)		6.58 ± 2.392				
No (n = 19)		4.63 ± 2.314				
Pro vs. retro	0.485	0.945	0.523	0.883	0.479	1.00

Table 4 Relation between process and outcome parameters concerning postoperative pain after bilateral sagittal split osteotomy (part 2)

	Sleeping impairment (n)	Mood disturbance (n)	Desire for pain medication (n)	Drowsiness (n)	Nausea (n)	Vomiting (n)
Gender	0.073	0.717	0.128	0.676	1.00	0.683
Age (median = 35)	0.479	1.00	1.00	0.172	0.011	0.172
<Median (n = 16)					n = 11	
>Median (n = 15)					n = 3	
Weight (median in kg = 70)	1.00	1.00	0.066	1.00	0.722	0.654
ASA (I vs. II)	1.00	0.031	0.023	0.383	0.153	0.383
ASA I (n = 20)		n = 6	n = 4			
ASA (n = 11)		n = 8	n = 7			
Duration of surgery (median in min = 105)	0.479	0.076	0.031	0.664	0.473	0.664
<Median (n = 17)			n = 3			
>Median (n = 17)			n = 8			
Counseling (specific vs. general vs. no)	0.581	0.462	0.226	0.769	1.00	0.769
PONY prophylaxis	1.00	0.107	1.00	1.00	1.00	0.355
Granisetron	1.00	0.198	0.676	0.293	0.671	0.11
Dexamethasone	0.479	0.285	0.458	0.394	1.00	1.00
Prednisolone	1.00	0.477	0.452	1.00	0.707	0.383
Opioid in recovery room	1.00	0.288	0.705	0.653	0.724	1.00
Opioid on ward	0.716	0.288	0.705	1.00	0.724	0.174
Pro vs. retro	0.479	0.722	0.458	0.654	0.073	0.654

All calculations were conducted with SPSS V 21.0 for Windows (SPSS, Inc., Chicago, IL).

Results

A total of 31 patients were enrolled. Eighteen (51.6%) patients were female and 13 (41.9%) male. The mean age was 35.8 ± 12.8 years at the time of evaluation. The mean body height was 169.4 ± 10.1 cm and mean body weight 70.6 ± 16.8 kg. Six patients regularly used pain medications for preexisting chronic pain, related to other diseases. Twenty (64.5%) patients were classified under ASA 1 and 11 (35.5%) ASA 2. Sixteen (51.6%) patients exhibited a skeletal class II malocclusion and 15 (48.4%) a skeletal class II. The mean duration of the surgery was 107.5 ± 40.4 min.

The results of the QUIPS questionnaire regarding the outcome of the performed postoperative pain management and pain-related parameters on the first postoperative day are given in Table 1. Mean NRS of minimal pain was 2.06 ± 1.84, whereas pain under strain was increased to 4.06 ± 2.29. The maximum pain levels showed a mean of 5.39 ± 2.50. Overall satisfaction with pain therapy was high (11.58 ± 2.49). Most patients reported to have received preoperative pain counseling (n = 27, 87.1%).

Concerning pain-related complaints, nearly half of the patients reported pain-related impairment of mobility, disturbance of mood, and sleep impairment. Nearly two fifths of the patients reported impairment of breathing. Most patients felt drowsiness due to surgery. Eleven (35.5%) patients desired more pain medication. Fourteen (45.2%) patients reported postoperative nausea and 6 (19.4%) vomiting.

The results of the selected process parameters of the performed pain management are given in Table 2. The standard sedative for premedication was midazolam. Intraoperatively, all patients received sufentanil and metamizol. Intraoral local anesthesia was performed in all patients using 2% lidocaine with 1:100,000 epinephrine (mibe GmbH, Germany). Clonidine was not applied. Prophylaxis of postoperative nausea and vomitus (PONV) was performed in nearly all patients by granisetron and/or dexamethasone.

In the recovery room, 12 (38.7%) patients received piritramide on an "as-needed" basis. The other patients did not require additional pain medication.

On ward, all patients received a non-opioid medication. The predominant non-opioid was metamizol (n = 29, 93.5%) applied in a dosage of 4 × 1 g. Twelve patients (38.7%) received additional tramadol as opioid. All patients received cold packs as physical pain therapy. For all individuals, patients' charts included instructions for pain therapy. Documentation of patients' pain was recorded in 29 (93.5%) of the charts.

Relations between the previously described outcome and process parameters are given in Tables 3 and 4. The duration of surgery above the median of 107.5 min was related to significantly lower satisfaction with postoperative pain intensity (p > .001) and significantly higher desire for additional pain medication (p = .023). Patients younger than the median age of 35 years showed significantly higher rates of postoperative nausea (p = .011). Mood disturbance (p = .031) and desire for additional pain medication occurred significantly more often in patients exhibiting an ASA II prior to surgery.

Patients receiving dexamethasone showed significantly higher pain on ambulation (p = .009) and lower satisfaction with pain intensity levels (p = .028). Patients receiving an opioid on ward presented significantly higher maximum pain intensity (p = .037).

Whether a skeletal class II or III was corrected did not influence the investigated parameters.

Discussion

Discussion of the method

For both, irrespective whether patient or doctor, sufficient acute postoperative pain management is of high priority as postoperative pain may result in patient discomfort and decreases patient satisfaction [10, 15–19]. It already could be demonstrated that a quality improvement strategy of postoperative pain management needs to be procedure specific [20, 21]. Key elements of such a sufficient quality improvement strategy should include continuous reassessments and analyses of structures, procedures, and outcomes [9, 21, 22].

In this context, the assessment of the postoperative pain management outcome, in terms of patients' pain and pain-related morbidity, is of special importance. Patients' pain perception is subjective and from high interindividual variation. Nurses' and physicians' pain appreciation regularly varies significantly from patients' pain perception [23–26].

Thus, in 2005, the outcome-oriented project called QUIPS was established in Germany. QUIPS is a project open for every hospital in Germany and is web based (http://www.quips-projekt.de). After assessment of patients' process and outcome parameters, standardized data sets are made anonymous and transferred to the external QUIPS database. The database allows the participating hospitals a procedure-specific internal benchmarking and on-going monitoring of processes regarding their postoperative pain management. It also enables an anonymous procedure-specific comparison of postoperative pain management outcomes of the different participating hospitals in terms of an external benchmarking. Such a standardized benchmarking system supports significantly the improvement of postoperative pain management [27]. Participating hospitals already adapted their postoperative pain management due to their benchmark results. It could be shown that QUIPS can help to significantly improve postoperative pain management quality [12, 21].

To date, there are no published data available regarding pain and the quality of postoperative pain management after BSSO. Thus, the presented study was performed, using the data revealed from the QUIPS database.

As a limitation, it has to be mentioned that the presented method does not allow conclusions about the further course of postoperative pain after the investigated first postoperative day. Another limitation of QUIPS is the absence of a preoperative pain assessment. Thus, we could not distinguish between pain caused by orthodontic appliances and functional disorders and surgically induced pain. Also, a Hawthorne effect cannot be excluded. Furthermore, the presented data have a monocentric character.

Discussion of the results

Whether a class II or III malocclusion was corrected did not significant influence the investigated parameters. Thus, it seems that whether a mandibular setback or an advancement is performed does not influence postoperative pain levels.

An 11-point NRS investigated means of pain levels ranged from 2.06 to 5.39 and may be considered moderate. The maximum pain level was comparable to earlier observed levels, e.g., in patients undergoing osteosynthetic forearm fracture repair (5.8) [12]. The observed high level of satisfaction with postoperative pain levels of 11.58 seems to underline this appraisal.

Regarding potential relations between process and outcome parameters, patients with a duration of surgery above the median presented a significantly lower satisfaction with postoperative pain levels ($p > .001$) and significantly higher desire for additional pain medication ($p = .023$). Longer duration of surgery is mostly associated with a complicated or extreme anatomic situation or also less operative experience of the performing

surgeon. It may be interpreted as a hint to prolonged and increased surgical trauma associated with higher demand of postoperative pain medication.

Surprisingly, those patients receiving additional opioids on ward exhibited significantly higher postoperative maximum pain levels (p = .037). This seems as a contradiction to the strong analgetic effect of opioids and the higher amount of analgetics received by those patients. But it could also be interpreted as an undersupply with opioids regarding dosage or type of opioid. Pain is a subjective, internal, and individual perception of each patient [23–26]. But not only this group showed analgetic undersupply. Altogether, 20 patients (64.5%) showed severe pain with NRS levels exceeding ≥4, which is an indication of inadequate pain management [28]. It may be assumed that these patients would have benefit from an additional medication of opioids, higher doses of opioids, or even stronger opioids. Taking this interpretation as a basis, we have to acknowledge that 64.5% of our patients were undersupplied with sufficient pain medication, especially opioids, which is a widespread problem [8, 29, 30]. Thus, QUIPS helped us to identify an unexpected overall undersupply with opioids on our ward, especially in patients just receiving opioids.

Conclusion

Summing up, in our opinion, QUIPS has shown to be an effective and practical instrument to measure postoperative pain after BSSO. Of our patients, 64.5% showed inadequate pain management with severe pain levels ≥4. Inadequate pain management was prevalent especially in patients just receiving metamizol or non-steroidal anti-inflammatory drugs but requiring opioids. Furthermore, analysis of process and outcome parameters showed that a duration of surgery above the median was associated with a higher need of postoperative pain medication.

References

1. Kehlet H (2004) Effect of postoperative pain treatment on outcome-current status and future strategies. Langenbeck's Arch Surg 389:244–249. doi:10.1007/s00423-004-0460-4
2. Wittekindt D, Wittekindt C, Meissner W, Guntinas-Lichius O (2012) Postoperative pain assessment after middle ear surgery. HNO 60:974–984. doi:10.1007/s00106-012-2556-4
3. Savoia G, Alampi D, Amantea B, Ambrosio F, Arcioni R, Berti M, Bettelli G, Bertini L, Bosco M, Casati A, Castelletti I, Carassiti M, Coluzzi F, Costantini A, Danelli G, Evangelista M, Finco G, Gatti A, Gravino E, Launo C, Loreto M, Mediati R, Mokini Z, Mondello E, Palermo S, Paoletti F, Paolicchi A, Petrini F, Piacevoli Q, Rizza A, Sabato AF, Santangelo E, Troglio E, Mattia C (2010) Postoperative pain treatment SIAARTI recommendations 2010. Short version. Minerva Anestesiol 76:657–667
4. Fries BE, Simon SE, Morris JN, Flodstrom C, Bookstein FL (2001) Pain in U.S. nursing homes: validating a pain scale for the minimum data set. Gerontologist 41:173–179
5. Gureje O, Simon GE, Von Korff M (2001) A cross-national study of the course of persistent pain in primary care. Pain 92:195–200
6. Warfield CA, Kahn CH (1995) Acute pain management. Programs in U.S. hospitals and experiences and attitudes among U.S. adults. Anesthesiology 83:1090–1094
7. Fletcher D, Fermanian C, Mardaye A, Aegerter P (2008) A patient-based national survey on postoperative pain management in France reveals significant achievements and persistent challenges. Pain 137:441–451. doi:10.1016/j.pain.2008.02.026
8. Apfelbaum JL, Chen C, Mehta SS, Gan TJ (2003) Postoperative pain experience: results from a national survey suggest postoperative pain continues to be undermanaged. Anesth Analg 97:534–540 table of contents
9. Gordon DB, Dahl JL, Miaskowski C, McCarberg B, Todd KH, Paice JA, Lipman AG, Bookbinder M, Sanders SH, Turk DC, Carr DB (2005) American pain society recommendations for improving the quality of acute and

cancer pain management: American Pain Society Quality of Care Task Force. Arch Intern Med 165:1574–1580. doi:10.1001/archinte.165.14.1574

10. Kehlet H, Wilkinson RC, Fischer HB, Camu F (2007) PROSPECT: evidence-based, procedure-specific postoperative pain management. Best Pract Res Clin Anaesthesiol 21:149–159

11. Rosenquist RW, Rosenberg J (2003) Postoperative pain guidelines. Reg Anesth Pain Med 28:279–288

12. Meissner W, Mescha S, Rothaug J, Zwacka S, Goettermann A, Ulrich K, Schleppers A (2008) Quality improvement in postoperative pain management: results from the QUIPS project. Dtsch Arztebl Int 105:865–870. doi:10.3238/arztebl.2008.0865

13. Dal Pont G (1961) Retromolar osteotomy for the correction of prognathism. J Oral Surg Anesth Hosp Dent Serv 19:42–47

14. Trauner R, Obwegeser H (1957) The surgical correction of mandibular prognathism and retrognathia with consideration of genioplasty. II. Operating methods for microgenia and distoclusion. Oral Surg Oral Med Oral Pathol 10:787–792 contd

15. Myles PS, Williams DL, Hendrata M, Anderson H, Weeks AM (2000) Patient satisfaction after anaesthesia and surgery: results of a prospective survey of 10,811 patients. Br J Anaesth 84:6–10

16. Neugebauer E, Sauerland S, Keck V, Simanski C, Witte J (2003) Surgical pain management. A Germany-wide survey including the effect of clinical guidelines. Chirurg 74:235–238. doi:10.1007/s00104-003-0615-9

17. Sommer M, Geurts JW, Stessel B, Kessels AG, Peters ML, Patijn J, van Kleef M, Kremer B, Marcus MA (2009) Prevalence and predictors of postoperative pain after ear, nose, and throat surgery. Arch Otolaryngol Head Neck Surg 135:124–130. doi:10.1001/archoto.2009.3

18. Ballantyne JC, Carr DB, deFerranti S, Suarez T, Lau J, Chalmers TC, Angelillo IF, Mosteller F (1998) The comparative effects of postoperative analgesic therapies on pulmonary outcome: cumulative meta-analyses of randomized, controlled trials. Anesth Analg 86:598–612

19. Beattie WS, Buckley DN, Forrest JB (1993) Epidural morphine reduces the risk of postoperative myocardial ischaemia in patients with cardiac risk factors. Can J Anaesth 40:532–541. doi:10.1007/BF03009738

20. Hyllested M, Jones S, Pedersen JL, Kehlet H (2002) Comparative effect of paracetamol, NSAIDs or their combination in postoperative pain management: a qualitative review. Br J Anaesth 88:199–214

21. Meissner W, Ullrich K, Zwacka S (2006) Benchmarking as a tool of continuous quality improvement in postoperative pain management. Eur J Anaesthesiol 23:142–148. doi:10.1017/S026502150500205X

22. Meissner W (2010) Focus on pain. Quality assurance in pain treatment. Anasthesiol Intensivmed Notfallmed Schmerzther 45:718–719. doi:10.1055/s-0030-1268874

23. Choiniere M, Melzack R, Girard N, Rondeau J, Paquin MJ (1990) Comparisons between patients' and nurses' assessment of pain and medication efficacy in severe burn injuries. Pain 40:143–152

24. Rundshagen I, Schnabel K, Standl T, Schulte am Esch J (1999) Patients' vs nurses' assessments of postoperative pain and anxiety during patient- or nurse-controlled analgesia. Br J Anaesth 82:374–378

25. Klopfenstein CE, Herrmann FR, Mamie C, Van Gessel E, Forster A (2000) Pain intensity and pain relief after surgery. A comparison between patients' reported assessments and nurses' and physicians' observations. Acta Anaesthesiol Scand 44:58–62

26. Sloman R, Rosen G, Rom M, Shir Y (2005) Nurses' assessment of pain in surgical patients. J Adv Nurs 52:125–132. doi:10.1111/j.1365-2648.2005.03573.x

27. Lehmkuhl D, Meissner W, Neugebauer EA (2011) Evaluation of the "initiative pain-free clinic" for quality improvement in postoperative pain management. A prospective controlled study. Schmerz 25:508–515. doi:10.1007/s00482-011-1054-z

28. Laubenthal H and Deutsche Interdisziplinäre Vereinigung für Schmerztherapie (2008) S3-Leitlinie Behandlung akuter perioperativer und posttraumatischer Schmerzen mit 97 Tabellen. Dt. Ärzte-Verl., Köln

29. Rathmell JP, Wu CL, Sinatra RS, Ballantyne JC, Ginsberg B, Gordon DB, Liu SS, Perkins FM, Reuben SS, Rosenquist RW, Viscusi ER (2006) Acute post-surgical pain management: a critical appraisal of current practice, December 2-4, 2005. Reg Anesth Pain Med 31:1–42. doi:10.1016/j.rapm.2006.05.002

30. Benhamou D, Berti M, Brodner G, De Andres J, Draisci G, Moreno-Azcoita M, Neugebauer EA, Schwenk W, Torres LM, Viel E (2008) Postoperative Analgesic THerapy Observational Survey (PATHOS): a practice pattern study in 7 central/southern European countries. Pain 136:134–141. doi:10.1016/j.pain.2007.06.028