Insufficient pain management after spine surgery

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ABSTRACT

INTRODUCTION: A prospective observational quality assurance study was performed at Glostrup Hospital, Denmark, to describe patients undergoing spine surgery with regard to perioperative analgesic management, post-operative pain, opioid consumption and side effects.

MATERIAL AND METHODS: Patients eligible for the study were identified consecutively from the operation chart. The following data were registered: post-operative visual analogue (VAS) pain score at rest and during mobilisation, opioid consumption for the first 24 h, other analgesics administered and side effects.

RESULTS: A total of 87 patients were included. For instrumented lumbar fusion patients (n = 24), the VAS pain scores at 1, 4 and 24 h after surgery were (median (interquartile range)) 5 (0-7), 2.5 (0-8) and 5.5 (0-9) at rest and 5 (0-8), 3 (0-9) and 7 (3-9) during mobilisation, respectively. The other surgical subgroups generally experienced VAS ≤ 3. For instrumented lumbar fusion, the total 0-24 h consumption of intravenous morphine equivalents was 39.1 (27.5-62.7) mg. Only eight of 87 patients received the entire scheduled standard post-operative pain treatment. Adverse events were rare.

CONCLUSION: Most patients experienced acceptable pain levels, but instrumented lumbar fusion leads to moderate to severe pain levels and a relatively high opioid consumption. The scheduled standard pain management protocols were sparsely followed. Challenges exist in post-operative pain management as observed in previous surveys, especially for instrumented lumbar fusion surgery. Future work should focus on optimising treatment plans.

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Pain after spine surgery is generated from skin, muscle tissue, vertebrae, intervertebral discs and facet joints and is highly dependent on the number of vertebrae included in the operation and the type of surgery performed [1, 2]. It is essential that pain management is effective and has a minimum of side effects and that it promotes rehabilitation and reduces post-operative morbidity. Several strategies are used in the management of pain after spine surgery, but there is a lack of systematic documentation of analgesic treatment in this population. No single strategy has proved to be generally effective and there is no "gold standard" [2, 3].

The purpose of this observational quality assurance study was to prospectively evaluate a consecutive cohort of patients undergoing spine surgery at the Centre for Spinal Disease at Glostrup Hospital, Denmark, with regard to perioperative analgesic management, post-operative pain levels, opioid consumption and incidence of side effects. In the study, we focused on the outcome of instrumented lumbar fusion surgery as it constitutes the most invasive of the surgical techniques.

MATERIAL AND METHODS

The study was conducted at the Department of Anaesthesiology and Centre for Spinal Disease at Glostrup Hospital. The local ethics committee did not require an approval as this was considered an observational, quality assurance study with no intervention. The study is reported according to the Strengthening the Reporting of Observational Studies in Epidemiology (STROBE) guidelines [4].

Patients

Patients eligible for the study were identified consecutively from the daily operation chart on the morning of their surgery. The inclusion criteria were adult patients undergoing anterior cervical interbody fusion, lumbar decompression, lumbar discectomy, non-instrumented lumbar fusion and anterior or posterior instrumented lumbar fusion. For all patients, the indication for surgery was degenerative spine conditions. The exclusion criteria were inability to cooperate and inability to speak or understand Danish.

Preoperative routine pain treatment

1 h before surgery, patients were scheduled to receive oral paracetamol sustained release 2,000 mg, morphine sustained release 10 mg and gabapentin 600 mg.

Perioperative routine care

General anaesthesia was induced and maintained with remifentanil (variable rate) and propofol (variable rate) or sevoflurane at the discretion of the anaesthetist. The patient's airways were managed with either orotracheal intubation or a laryngeal mask. Rocuronium (0.6 mg/kg) was used to facilitate orotracheal intubation. Hypotension was treated with isotonic sodium chloride, hydroxyethyl starch (130/0.4), ephedrine and/or metaoxedrin intravenously. Thirty minutes before anticipated termination of surgery, morphine 0.2 mg/kg was delivered.

ORIGINAL ARTICLE

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TABLE 1

Patient characteristics and baseline information.

	ACIF	Lumbar decompression	Lumbar discectomy	Non-instrumented lumbar fusion	Instrumented lumbar fusion
Patients, n	22	16	19	5	25
Age, mean (SD), yrs	54 (13.3)	72 (5)	43 (12.5)	44 (12.8)	56 (15)
Sex, M/F, n	7/15	10/6	10/9	11/9	7/18
Height, mean (SD), cm	171 (10.1)	173 (8.4)	178 (9.1)	178 (8.6)	171 (10.4)
Weight, mean (SD), kg	76 (16.6)	83 (10.3)	85 (21.2)	85 (20)	82 (15.4)
Usual use of non-opioid and weak opioid analgesics[a], n	11	7	11	2	18
Usual use of strong opioids[b], n	2	1	4	1	1

ACIF = anterior cervical interbody fusion; F = female; M = male; SD = standard deviation.
a) Paracetamol, ibuprofen, tramadole hydrochloride, chlorzoxazone, gabapentin.
b) Morphine, sustained release morphine, ketobemidone, fentanyl, methadone, oxycodone.

Post-operative routine care

In the post-anaesthesia care unit, pain treatment primarily consisted of morphine and/or intravenous (IV) sufentanil supplied as needed. Nausea was treated with IV ondansetron.

At the surgical ward, patients were scheduled to receive one of two standardised post-operative pain treatment regimens:

Patients undergoing lumbar discectomy, lumbar decompression, non-instrumented fusion and cervical interbody fusion were scheduled for oral paracetamol 1 g every 6 h, ibuprofen 400 mg every 8 h and sustained release morphine 10 mg every 12 h. Supplemental medication was oral morphine 10 mg or IV morphine 5 mg when needed.

Patients undergoing instrumented lumbar fusion surgery were scheduled for oral paracetamol 1 g every 6 h, ibuprofen 400 mg every 8 h and sustained release morphine 20 mg every 12 h and gabapentin 300 mg every 8 h. Supplemental medication was oral morphine 10 mg or IV morphine 5 mg, when needed. Nausea and vomiting were treated with ondansetron IV.

Outcomes

The outcome measures were adherence to scheduled pain management, post-operative visual analogue (VAS) pain score at rest and during mobilisation (defined by a standardised movement from recumbent position to sitting on the bedside or standing up), opioid consumption 0-24 h after operation, and side effects: levels of sedation, nausea and use of antiemetic.

Data registration

For all patients, the following data were registered: preoperative diagnosis; pain medication before hospitalisation; scheduled and observed analgesic treatment preoperatively, and 0-24 h post-operatively; VAS pain scores (0-10 cm; 0 = no pain, 10 = worst pain imaginable) at rest and during mobilisation at 1, 4 and 24 h post-operatively. Further, sedation and nausea (verbal rating scale: none, mild, moderate and severe) were registered at 0, 1, 2 , 3 and 4 h post-operatively together with total use of antiemetic treatment 0-4 h post-operatively. Information regarding patient medication (0-24 h post-operatively) and diagnosis were extracted from the Electronic Patient Medication and the Electronic Patient Chart. Assessments of pain and side effects were performed by trained nurses.

Data presentation

We used a Q-Q plot to compare our data with a normal distribution. Patient characteristics were symmetrically distributed and are therefore presented as a mean with standard deviation. Pain scores, adverse events and opioid consumption data are not symmetrically distributed and are therefore presented as a median with range. Numerical values were attributed to verbal scores of nausea and sedation: none = 1, mild = 2, moderate = 3 and severe = 4.

Opioids were converted into their IV morphine equivalents based on the equivalence of IV morphine and oral morphine (1:3), IV morphine and IV sufentanil (1000:1), oral morphine and oral ketobemidone (2:1) and oral morphine and oral tramadol (1:10).

Trial registration: not relevant.

RESULTS

The study was carried out at Glostrup Hospital from May 2012 to June 2012. Prospective data from 87 consecutive patients scheduled for spine surgery, 52 female and 35 male, with a mean age of 56 (range: 26-87) years, were included in the study. Patient demographics and perioperative data are presented in **Table 1**.

Usual pain medication

A total of 54 patients received analgesic treatment before hospitalisation. In the overall study population, 15 patients used strong opioids at home with the highest incidence being observed among instrumented lumbar fusion patients (seven of 24 patients) (Table 1).

Adherence to treatment regimen

Most patients (83 of 87) received the planned standard preoperative analgesic treatment.

During the first 24 h post-operatively, 43 patients received their scheduled paracetamol, 16 received their scheduled ibuprofen, 11 received their scheduled gabapentin, and 43 received their scheduled sustained release morphine. Only eight patients received the entire scheduled standard post-operative pain protocol.

Administration of other analgesics

At the beginning of surgery, 53 patients received infiltration analgesia with local anaesthetics, and 18 patients received infiltration analgesia at the end of surgery. Both were administered at the discretion of the surgeon. Post-operatively, 15 patients received chlorzoxazone, 17 patients received tramadole, seven patients ketobemidone, four patients oxycontin and four patients codeine.

Pain

Pain scores 24 h after surgery for instrumented lumbar fusion patients are summarised in **Table 2**. At 1 and 4 h after surgery, nine of 24 and 15 of 24 instrumented lumbar fusion patients had a VAS ≤ 3 during rest. At 1 and 4 h after surgery, eight of 24 and 15 of 24 instrumented lumbar fusion patients had a VAS ≤ 3 during movement. At 24 h after surgery, four of 23 patients and one of 23 patients, respectively, had a VAS ≤ 3 during rest and movement.

TABLE 2

Post-operative visual analogue scale (VAS) pain scores after instrumented lumbar fusion.

Time after surgery	Pain at rest, median (range)	Pain at movement, median (range)	VAS ≤ 3, rest, n	VAS ≤ 3, movement, n
1 h	5 (0-7)	5 (0-8)	9/24	8/24
4 h	2.5 (0-8)	3 (0-9)	15/24	15/24
24 h	5.5 (0-9)	7 (3-9)	4/23	1/23

Regarding the remaining spine surgery patients as one group, at 1, 4 and 24 h after surgery, 35 of 60, 52 of 61 and 17 of 27 patients, respectively, had a VAS ≤ 3 during rest.

At 1, 4 and 24 h after surgery, 41 of 57, 46 of 63 and 13 of 27 patients, respectively, had a VAS ≤ 3 during movement.

Opioid consumption

Opioid usage is summarised in **Table 3**. Instrumented lumbar fusion patients consumed a total of 39.1 (27.5-62.7) mg IV morphine equivalents 0-24 h post-operatively. All of them needed escape opioids.

Adverse events

A total of 15 patients experienced nausea 0-4 h post-operatively. The median nausea score in this period was 0 (0-0). There was no difference in the severity of the nausea in the surgical subgroups. Nine patients were treated with an antiemetic.

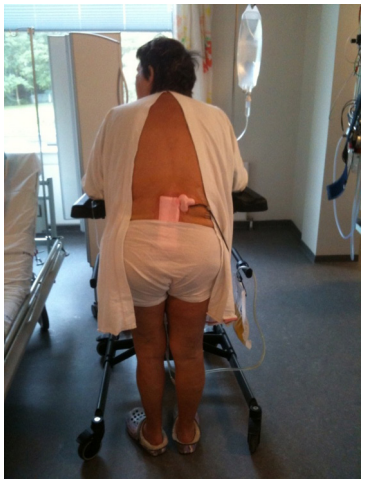
In all, 48 patients experienced sedation 0-4 h post-operatively. The median sedation score in this period was 0 (0-0). Three patients received naloxone post-operatively, due to sedation and insufficient respiration.

TABLE 3

Opioid consumption 0-24 h post-operatively.

	ACIF (N = 22)	Lumbar decompression (N = 16)	Lumbar discectomy (N = 19)	Non-instrumented lumbar fusion (N = 6)	Instrumented lumbar fusion (N = 24)
Total opioid consumption[a], 0-24 h, median (interquartile range)	17.8 (10-38.1)	14.2 (9.6-17.5)	21.6 (15-48.3)	22.5 (17.5-31.2)	39.1 (27.5-62.7)
Scheduled opioids[a], surgical ward, median (interquartile range)	10 (3.3-10)	10 (3.3-10)	10 (6.6-16.6)	8.3 (6.6-15)	16.6 (13.3-18.3)
Escape opioids[a], PACU, median (interquartile range)	9.2 (0-21.3)	0 (0-3.8)	10 (0-26.3)	4.2 (0-15.8)	16.3 (8.8-33.5)
Escape opioids[a], surgical ward, median (interquartile range)	0 (0-5)	0.8 (0-3.7)	3.3 (0-3.3)	4.2 (0.4-6.7)	6.7 (3.3-12.5)
Received scheduled opioids, n	8	9	8	2	15
Received escape opioids, n	9	8	13	4	20

ACIF = anterior cervical interbody fusion; PACU = post-anaesthesia care unit.
a) Expressed as intravenous morphine equivalents.



Patient 3 h after spinal fusion surgery.

DISCUSSION

This prospective, observational and non-interventional study aimed to describe perioperative management of patients undergoing spine surgery in relation to adherence to scheduled pain treatment, administration of other analgesics, post-operative pain levels, need for opioids and incidence of side effects. The study demonstrated several post-operative pain treatment issues with a potential for improvement. We observed an acceptable adherence to the scheduled, preoperative medication. However, only eight out of 87 patients received the full standard post-operative treatment protocol. This finding is obviously not satisfactory, but comparable with findings from similar, recent studies [5].

We also observed that patients undergoing instrumented lumbar fusion surgery at Glostrup Hospital displayed moderate to severe pain levels early and especially late post-operatively both at rest and during mobilisation during the first 24 h [6-8]. It is clear from our results that the instrumentation during lumbar fusion surgery constitutes the most invasive of the surgical techniques and that it is associated with higher pain levels and a greater need for analgesics post-operatively than other procedures. Recent reports suggest an individual clinical goal of "no more than mild pain" (VAS ≤ 3) as a simple and relevant measure of pain after a surgical procedure [9]. A larger fulfilment rate may have been achieved by adherence to the scheduled standard pain protocol treatment. Especially instrumented lumbar fusion surgery patients could possibly benefit from this, as noticeably fewer had a VAS ≤ 3 both early and particularly in the late post-operative phase as compared with the rest of the spine surgery patients. Also, instrumented lumbar fusion surgery patients had the highest opioid consumption. All of them received supplemental opioids, but only 15 of 24 patients received their scheduled opioids. This, again, indicates a possible benefit in this population from an optimised post-operative analgesic treatment regimen.

In the current literature, there is no consensus or "gold standard" for pain management in this surgical population. Wound infiltration with local anaesthetics and chlorzoxazone are not a part of the standard analgesic regimens in the department, but are administered at the discretion of individual surgeons or anaesthetists. The analgesic effect of wound infiltration with local anaesthetics for post-operative pain relief in spine surgery is, however, questionable [10]. Furthermore, although chlorzoxazone is often used as an adjuvant analgesic in various clinical settings, including spine surgery [11, 12], the analgesic effect has not been documented in any randomised clinical trial.

Contemporary post-operative pain management includes multimodal analgesia with non-opioid analgesics and with opioids administered only as escape medication [13, 14]. Paracetamol, non-steroidal anti-inflammatory drugs (NSAID), steroids and gabapentinoids are the most commonly non-opioid analgesic in these combination regimens. Steroids are not a part of the standard post-operative pain management in the present department, but they have recently been shown to be effective for post-operative pain treatment. Thus, a single moderate dose of dexamethasone (0.11-0.2 mg/kg) reduced both opioid consumption and pain after various surgical procedures [15]. Other studies indicate that a single high dose of glucocorticoid may further improve analgesia and promote recovery after orthopaedic surgery [16, 17]. It may be speculated if a combination of fixed interval treatment with a combination of paracetamol, NSAID and dexamethasone, and gabapentin in the most painful procedures, could reduce or even eliminate the need for opioids in most patients after moderately sized spine surgery [13].

There are several limitations to this study. The design is observational and may therefore introduce bias, the number of patients in some of the surgical subgroups was relatively small and the calculation of a morphine equivalent from different opiates with different pharmacokinetic and pharmacodynamic profiles may be questioned.

CONCLUSION

In summary, patients undergoing instrumented lumbar fusion surgery generally experienced rather high pain scores and opioid consumption. In general, only a minority followed the full scheduled standard pain management protocols. Future work in this area should focus on organisational adaptation to treatment plans. Furthermore, randomised trials must clarify if patients may benefit from more extensive multimodal pain treatment regimens including glucocorticoids, and if wound infiltra-

tion with local anaesthetics and systemic chlorzoxazone is warranted in this surgical population.

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