Spinal fentanyl for primary total hip arthroplasty: A double-edged sword? A clinical audit data analysis

INTRODUCTION

Hip surgery is usually performed on frail and elderly patients. Therefore, tailoring the anaesthetic management to the comorbidity is essential. Neuraxial and regional anaesthetic techniques have been related to multiple benefits in these patients, even in terms of mortality. The synergic effect of spinal local anaesthetics (LAs) and opioids provide additional analgesic effects and allows a reduction of the LA dose, and this reduces haemodynamic derangement and the risk of systemic toxicity.[1] Lipophilic and hydrophilic opioids can be used for this purpose. The shorter half-life and the adverse effects of lipophilic opioids limit their analgesic benefits to the intraoperative period. They exert their effects at the regional and systemic levels but have lower spinal selectivity.[2] Hydrophilic opioids have greater cranial diffusion in the cerebrospinal fluid and a longer duration of action, and hence, the risk of the appearance of side effects, particularly, respiratory depression, is prolonged over time.

Despite the intraoperative advantages of spinal fentanyl, evidence about its benefits regarding postoperative analgesia is scarce. Previous reports indicate that it could improve postoperative analgesia after obstetric interventions and rebound pain after perineal surgery under spinal anaesthesia.[3] However, there are few references related to its influence on analgesia after major lower limb trauma surgery.[4] The aim of the present study was to evaluate the influence of anaesthetic management on postoperative pain after primary total hip arthroplasty (PTHA). The primary objective was the assessment of opioid consumption in the postanaesthesia care unit (PACU) according to the amount of intrathecal fentanyl administered. The secondary objective was the evaluation of the need for further doses of opioids in the general ward during the first 48 postoperative hours.

METHODS

This study was conducted as an institutional clinical audit. Ethical approval for this study was provided by the corresponding ethics committee (approval number 2020/397, dated 29th July 2020). The research ethical board waived the requirement for informed consent, as this study was considered a clinical audit, according to the Guide for Research Ethics Committee Members, produced by the Steering Committee on Bioethics of The Council of Europe.

We performed a retrospective analysis of 292 consecutive patients subjected to PTHA from May 2018 to November 2020 [Figure 1]. Data of patients in whom general anaesthesia was used and reinterventions were done was not collected.

Intraoperative management including the use or avoidance of spinal fentanyl and the performance of supplemental regional anaesthetic techniques was as per the concerned anaesthesiologist. Apart from the demographic characteristics of the patients and the indication for surgery, the data collected included the intrathecal drugs used and their dose, the duration of the surgery and the concomitant use of a nerve block before performing the subarachnoid puncture (as well as the drug used, its dose and concentration).

An institutional multimodal postoperative analgesia protocol was applied to all patients. This included the intravenous administration of 1000 mg of paracetamol every 8 h alternating with 50 mg of dexketoprofen every 8 h from the start of the intervention, except for allergic patients. In cases of severe or moderate renal failure, or the presence of other contraindications for dexketoprofen, metamizole was administered instead of dexketoprofen (at a dose of 1500 mg every 8 h). The preoperative or intraoperative use of corticosteroids as an analgesic adjuvant was avoided, limiting their administration to cases in which it was indicated (chronic corticosteroid treatment, prevention of adrenal insufficiency or medical conditions that

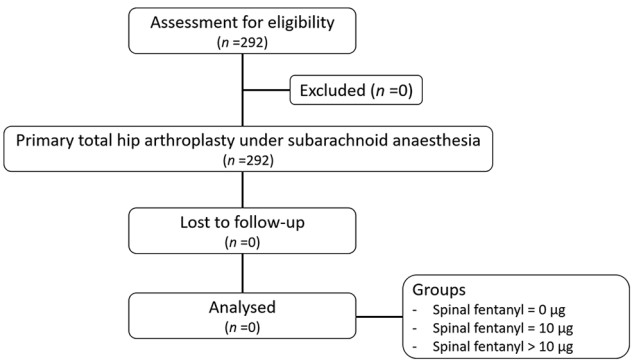

Figure 1: Flow of the patients in the study

warrant their use, such as bronchospasm or idiopathic thrombocytopenic purpura). If necessary, doses of 3–5 mg of morphine chloride were administered and repeated after an interval of 30 min if the visual analogue scale score remained ≥2. The evaluation of postoperative opioid consumption was performed in the PACU, by measuring the total dose of morphine chloride required therein, and in the conventional ward during the first 48 postoperative hours (excluding the PACU time), evaluating the proportion of patients who required additional doses of opioids.

The primary and secondary outcomes were evaluated according to the amount of intrathecal fentanyl administered. Statistical analysis was performed using the statistical program statistical package for the social sciences (SPSS)® (International Business Machines Corp. version 28.0. Armonk, NY, USA). For the comparison of variables on a nominal or ordinal scale, the Chi-square test was performed. The Kruskal–Wallis test for independent samples was applied to compare three groups for numerical variables: 0 μg (n = 25), 10 μg (n = 255) or >10 μg (n = 12). A Bonferroni correction was performed if significant differences were reached. Statistical significance was set at $P < 0.05$.

RESULTS

Data from a total of 292 patients were obtained [Table 1]. The analysis was carried out by dividing the sample into the following three groups according to the amount of intrathecal fentanyl received: 0 μg (n = 25), 10 μg (n = 255) or >10 μg (n = 12). The mean consumption was 4.76 mg ± 4.8 (95% confidence interval [CI] 3.05–4.67 mg) in the 0 μg group, 4.39 mg ± 4.4 (95% CI 3.87–4.91 mg) in the 10 μg group and 7.33 mg ± 3.6 (95% CI 5.06–9.61 mg) in the >10 μg group [Figure 2]. There were no statistically significant differences between the 0 μg and 10 μg groups (P = 0.802). The difference was significant when the consumption was compared between the groups of 10 and >10 μg (P = 0.008) and the groups of 0 and >10 μg (P = 0.037). However, when applying the Bonferroni correction, the adjusted significance was P = 0.024 and P = 0.111, respectively, probably related to the size of the smaller groups. Even so, the statistical trend was maintained and could be confirmed with larger samples or exploratory studies.

Furthermore, as there was a much lower proportion of extreme results in the >10 μg group, these were not excluded from the analysis as they could falsely increase the differences between groups [Figure 2].

Table 1: Baseline characteristics, anaesthetic management and pain-related outcomes

	Amount of intrathecal fentanyl (μg)			
	0 μg (n=25)	10 μg (n=255)	>10 μg (n=12)	*P*
Gender (male: female ratio)	14:11	122:143	6:6	0.498
Age (mean±SD)	69.24±13.14	69.29±10.70	70.5±16.11	0.691
ASA status (n)				0.013*
I or II	12 (48%)	171 (67.1%)	4 (33,3%)	
III or IV	13 (52%)	78 (32.9%)	8 (66.4%)	
Surgery indication (n)				0.63*
Coxarthrosis	17 (68%)	168 (65.9%)	4 (33.3%)	
Fracture or other	8 (32%)	87 (34.1%)	8 (66.7%)	
Length of surgery (min) (mean±SD)	73.8±13.73	78.72±23.46	85.42±20.54	0.340
LA used				
Hyperbaric bupivacaine (n)[a]	22 (88%)	246 (96.5%)	11 (91.7%)	0.117
Plain levobupivacaine (n)[a]	3 (12%)	9 (3.5%)	1 (9.3%)	
Spinal LA dosage (mg) (mean±SD)	11.29±1.73	10.6±3.29	10.9±1.3	0.156
Nerve block				
No nerve block (n)	14 (56%)	137 (53.7%)	8 (62.8%)	0.630[b]
Femoral block (n)	4 (16%)	82 (32.1%)	1 (9.3%)	
PENG block (n)	4 (16%)	29 (11.4%)	3 (27.9%)	
Fascia iliaca block (n)	2 (8%)	5 (2%)	0 (0%)	
Cutaneous femoral block (n)	1 (4%)	2 (0.8%)	0 (0%)	
LA[a] concentration block (%) (mean±SD)	0.36±0.1	0.336±0.09	0.375±0.08	0.826
Opioid usage in PACU (mg) (mean±SD)	4.76±4.76	4.39±4.2	7.33±3.58	0.029
Patients requiring opioids in 48 h (%)	25	25.88	25	0.995

[a]Concentration 0.5% (all cases). [b]Comparison between nerve block and no nerve block. *Difference was only statistically significant between the 10 and >10 μg groups. ASA=American Society of Anesthesiologists, LA=local anaesthetic, PACU=postanaesthesia care unit, PENG=pericapsular nerve group, SD=standard deviation

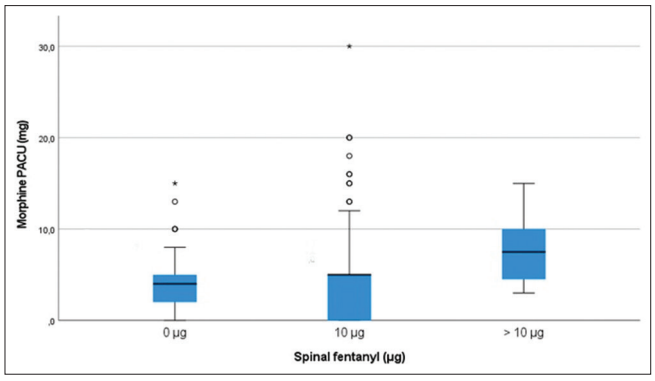

Figure 2: Box plot -Comparison of the opioid consumption according to the amount of intrathecal fentanyl (blue: interquartile range). PACU = postanaesthesia care unit

DISCUSSION

According to our results, the use of intrathecal fentanyl as an adjuvant for a subarachnoid block in doses greater than 10 µg could be associated with higher consumption of opioids in the immediate postoperative period after PTHA. On the other hand, a similar consumption of morphine in the PACU was observed in the 10 and 0 µg groups. The percentage of patients who required additional opioids in the conventional ward was not significantly different.

To date, evidence about the influence of intraoperative spinal fentanyl shows variable results regarding postoperative pain, especially in obstetric anaesthesia.[5] However, in orthopaedic surgery, this evidence is scarcer and even contradictory. Several previous reports link fentanyl to worsening pain.[6] The nature of these findings could be explained by several mechanisms. Opioid-induced hyperalgesia is driven by the sensitisation of pain pathways by these drugs.[6] However, it is usually associated with short half-life opioids or higher doses than those used in subarachnoid anaesthesia. Acute tolerance is related to the desensitisation of these pathways, and it is usually related to higher doses of the drug as well.[7] On the other side, acute withdrawal of opioids is related to a relative underdosing of the drug and an acute offset of the effect, especially in chronic opioid users. The latter mechanism would be the most likely, as the fentanyl doses used intrathecally are relatively low and its continuous administration by the epidural route could lead to better analgesia.[8] However, previous reports link these findings to cross-tolerance between opioids.[5] The systemic effects exerted by lipophilic intrathecal opioids could also support the latter hypothesis.

Other mechanisms, such as rebound pain after the use of neuraxial anaesthesia or peripheral nerve block, could be implicated. However, there is evidence that intrathecal fentanyl could even attenuate these mechanisms in anorectal surgery.[3] The predominance of the visceral component of pain, as opposed to the somatic one, could also play a role.

Therefore, the addition of spinal fentanyl to LA should be considered in each case, depending on the expected benefits. Reduction of the LA dose may be essential in frail or traumatic patients[9] or in those with cardiovascular disease. So, spinal fentanyl should be considered in this population, although other regional alternatives like continuous lumbar epidural anaesthesia or lumbosacral plexus blocks could be superior.[10] The beneficial effects of intradural fentanyl should also be considered, particularly from a haemodynamic point of view.[1]

However, the retrospective nature of this study and the low number of patients in some groups limit the generalisability of our findings. As this was a clinical audit, the data reflect the usual clinical practice in our institution: they clearly point out that there is a preference for the use of bupivacaine, and that the addition of 10 µg intrathecal fentanyl is very frequent, resulting in the distribution we present. This might be a reflection of the emerging evidence on new approaches to postoperative analgesia after hip surgery, which seem to be superior to the classical ones.[11,12]

CONCLUSION

In conclusion, our findings indicate that the utilisation of low doses of intrathecal fentanyl and even the avoidance of its use for PTHA might confer benefits in terms of lower early postoperative pain and opioid consumption. Further evidence is required to clarify the role of spinal fentanyl in perioperative outcomes in hip surgery.

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Conflicts of interest

There are no conflicts of interest.

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