Review

Local infiltration analgesia following total hip replacement: a review of current literature

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【**Abstract**】Controlling postoperative pain after total hip replacement is important and controversy remains regarding different regimens. By reviewing 18 studies, we attempt to find whether local infiltration analgesia after total hip replacement has any effect on postoperative pain, length of hospital stay and opioid consumption. We conclude that local infiltration analgesia is an effective method for decreasing postoperative pain.

Key words: ***Arthroplasty, replacement, hip; Analgesia; Pain, postoperative***

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Controlling pain after total hip replacement (THR) is a major challenge as it can impair activities of daily life,[1,2] early mobilization and rehabilitation, which in turn affects overall recovery. One of patient's biggest concerns is pain during the recovery period after THR; more than half of the patients reportedly receive suboptimal pain control postoperatively.[3]

In recent years local infiltration analgesia (LIA) is gaining popularity. LIA involves local infiltration of a large volume of dilute solution of a long acting local anaesthetic agent in combination with non-steroid anti-inflammatory drugs (NSAID),[4] adrenaline, opioids, and/or steroids[5] into all tissues exposed, instrumented or incised during surgery. This effect can be prolonged by placing a catheter for postoperative administration of local anaesthetics.

Our primary objective based on the current evidence was to review the literature pertaining to the use of LIA to determine if LIA is superior compared to no intervention, placebo or alternate analgesic methods after THR, in terms of effective safe analgesia, shorter hospital stay and better functional outcomes.

LITERATURE REVIEW

We searched the PubMed database for English language articles using the phrase 'total hip arthroplasty analgesia' and 'local anaesthetic infiltration after THR'. This produced 355 and 20 matches respectively. Studies relating to intraoperative infiltration of local analgesia for postoperative pain relief after THR were selected. Nonrandomized control trials and studies that did not record any pain score or analgesic consumption were excluded, leaving a total of 18 studies (16 randomized control trials and two case series) to review. The studies were divided into two categories: those involving local administration of a single dose of analgesic intraoperatively (7 studies);[5-11] and those using either a continuous infusion or multiple administrations of analgesics to the hip joint (11 studies).[4,12-21]

The primary outcome measures were postoperative pain scores, amount of opioid consumption, and length of hospital stay (LOS). Other outcome measures included patient satisfaction and functional recovery.

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RESULTS

Out of 18 studies, four studies[5,12,14,15] looked at the mixed population of patients undergoing THR, total knee arthroplasty (TKA) and hip resurfacing arthroplasty (HRA).

Studies involving local administration of a single dose of analgesic intraoperatively

Of the seven studies[5-11] identified, three studies[8,10,11] did not record LOS and two studies[5,6] did not comment on opioid consumption. Four studies[5-7,11] concluded that local infiltration was beneficial in providing analgesia, two studies[7,10] reported less opioid consumption and only one study[5] found decreased LOS with LIA technique. Pandazi et al[11] reported lower opioid consumption and pain scores in LIA when compared to patient controlled analgesia (PCA) but no difference in comparison with epidural group.

Studies including continuous infusion or multiple administrations of analgesics

Of the 11 studies[4,12-21] identified, three[12,16,20] used continuous infusions and eight[4,13-15,17-19,21] used multiple administrations of local analgesics to the hip joint following THR.

In studies using continuous infusion of local anaesthetics (LA), the catheter was placed for 48 h[16,20] and 55 h[12]. Different techniques of LA infusion like intraarticular (IA),[16] extraarticular (EA)[12] and epicapsular[20] were compared with saline infusion. Two[12,20] of the studies described positive effects of their technique on opioid consumption, pain scores and patient satisfaction, while Chen et al[16] noticed no difference in opioid consumption or pain scores. None of these three studies found any incidence of local site infection in spite of prolonged infusion.

Salmi et al[19] and Kuchalik et al[21] compared LIA with intrathecal morphine (IT-M) and recorded different results, and both reported more side effects in IT-M group like delayed mobilization,[19] more postoperative catheterization,[19] pruritus[19,21] and nausea and vomiting.[21] Anderson et al[4] compared continuous epidural infusion for 20 h with LIA combined with IA injection of LA 8 h postoperatively and reported better results in LIA group but more side effects in epidural infusion group. Kerr and Kohan[14], who first brought widespread attention to LIA use, published a case series of 325 patients who were given LIA intraoperatively with subsequent IA injection at 15-20 h postoperatively. During the postoperative period, pain scores were generally satisfactory (0-3/10) and 2/3 of the patients did not require morphine and mostly were able to walk with assistance at 5-6 h. The exact infiltration method was used by Otte et al[15] in a subsequent series of 24 patients with similar efficacy. Three studies[13,17,18] compared multiple administrations of analgesics with placebo saline in which the last injection was given at 22-24 h after surgery. Anderson et al[13] published lower VAS scores upto 2 weeks following THR while the other two did not demonstrate any significant difference in pain scores during the study period.[17,18]

A total of 14 studies[4-7,9,12-19,21] out of 18 measured LOS and three[4,5,12] demonstrated significant reduction in LOS with local infiltration.

DISCUSSION

Postoperative pain control after THR is a major concern as it influences mobilization and the overall recovery of patients. Various established treatment modalities include epidural analgesia, PCA, peripheral nerve blocks (PNB), opioids and NSAIDS. Though epidural analgesia is a well-established method for optimal pain control after THR, it is not devoid of side effects such as urinary retention, motor blockade, hypotension, pruritus and epidural haematoma.[22,23] Similarly, opioid analgesia is also associated with increased risk of nausea, vomiting, respiratory depression, pruritus, urinary retention and drowsiness.[24,25] Use of PNB is equivalent in providing analgesia when compared to epidural analgesia with a lower incidence of hypotension and urinary retention but requires a level of expertise to perform and are time consuming.[26,27]

With recent trends toward early mobilization after THR, a comprehensive analgesic regimen that provides optimal analgesia without impairing motor function and with minimal side effects is desirable. A new method with all desirable qualities is local infiltration combined with single shot or continuous infusion/multiple administrations of local anaesthetics into the surgical site.

LIA provides site specific analgesia, and placement of a periarticular catheter enables continuous or repeated dosing that extends the duration of effect. Components used in the LIA mixture vary considerably and include LA (ropivacaine,[4,6-8,11,12-14,15,17,18,20,21] bupivacaine,[5,16] levobupivacaine,[9,10,19]) epinephrine, NSAIDS, corticosteroids,[5,6,11] morphine[5-7,11] and clonidine.[11] All these components exert their actions through different mechanisms. Ropivacaine[28] and levobupivacaine[29,30] are long acting LA and have relatively low cardiac and central nervous system toxicity. Epinephrine, by causing vasoconstriction, prolongs the effect of LA and decreases their systemic toxicity by decelerating the systemic drug uptake.[13] Corticosteroids exert their effect by local anti-inflammatory action. Single low dose methylprednisolone attenuates local stress response without increasing infection rate or impairing wound healing.[8] Opioids have a synergistic action with LA mainly through μ opioid receptors in the periarticular tissues.[5] NSAIDS alter peripheral nociceptors by reducing the local concentration of allogenic chemicals.[31] Clonidine prolongs local anaesthetic action but its use as periarticular infiltration is limited.[32]

Two studies[4,11] compared epidural infusion with periarticular infiltration. In a study by Pandazi et al[11] the efficacy of infiltration in providing lower pain score after THR was consistent with the results of epidural infusion. Anderson et al[4] noticed that the epidural technique was not effective, and was associated with more negative side effects. Periarticular infiltration turns out to be a satisfactory and safe analgesic alternative to epidural analgesia especially when concerns over hemodynamic and coagulant status emerge. Some examples are: patients with aortic stenosis, impaired coagulation, or patients receiving antiplatelet drugs that should not be discontinued perioperatively.[11] An additional benefit of the infiltration technique is reduced blood loss in postoperative drainage, which could be due to the addition of epinephrine in the solution.[11]

Out of 18 studies, only four[10,12,16,20] used LA in isolation in the intervention group. Of the four studies, two[10,16] reported no beneficial effect on the postoperative pain score. Murphy et al[10] used only single administration of levobupivacaine intraoperatively while Chen et al[16] used continuous infusion of bupivacaine for 48 h by placing the catheter intraarticularly. Poor pain control in this study could be explained by the inability of bupivacaine to reach nociceptors outside the joint. While the other two studies[12,20] described positive effect of LA. Both used continuous infusion of LA by placing the catheter extraarticular and epicapsular respectively. However, little is known about the optimal catheter placement so more trials are needed in this concern.

Of the 14 studies[6,7,9,12-19,21] that investigated the effect of local infiltration on hospital stay, eleven [6,7,9,13-19,21] found it to make no significant difference. LOS following THR depends on the preoperative condition of patient and the surgical technique, but more on the actual organizational protocol than on the LIA technique itself.

Of the eleven[4,12-21] studies providing data on the efficacy of multiple administrations, only seven[12-15,20,21] showed promising effects in regard to postoperative pain. Specht et al[18] made a change only in the postoperative bolus drug LIA mixture vs. saline and concluded that postoperative bolus did not seem to offer any additional benefit to intraoperative LIA.

Another possible concern associated with postoperative administration is a potential risk of infection and delayed wound healing. Only one patient in Anderson et al[4] study developed deep infection but the data were not statistically significant. Bianconi et al[12] inspected the catheter tip for microbial analysis after removal at 55 h and the results were negative for growth. In three studies[12,16,20] an intra-articular catheter was in place for 55 h, 48 h, and 48 h respectively without any sign of infection or delayed wound healing. However, in many studies the follow-up period was not sufficient to detect infection. Of all the published studies which investigated the use of indwelling catheter for administration of LA, none have proven whether it increases the risk of infection. However, we cannot deny the fact that it could be a potential source of infection. If proper aseptic techniques are maintained for insertion and bolus administration,

the risk of infection can be minimized.

In conclusion, the LIA technique has been shown to be an effective and safe method, though the published data about the use of LIA following THR are from relatively small number of clinical trials. The major concerns regarding the site of placement and risk of infection associated with indwelling catheter are not yet clear, so further trials with a larger sample size and longer follow-up are recommended.

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