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Review Article

Enhanced recovery protocols in total hip and knee arthroplasty: what are the recent trends

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ABSTRACT

Perioperative management of hip and knee arthroplasty patients has evolved significantly over the past few years, almost hand in hand with the advancement of the surgical technique itself. The notion of enhanced recovery protocol is rapidly being accepted by various establishments to reduce the hospital stay and perioperative morbidity. It consists of application of aggressive perioperative interventions aiming for a speedy recovery with least complications, while maintaining good patient care. We reviewed various published articles to understand the importance of each of these interventions. Components that showed improvement in the outcomes were patient education and counselling, pre-operative supplementation to improve wound healing and reduce length of hospital stay. Intra-operative use tranexamic acid and avoidance of drains reduce operative blood loss and subsequent transfusion. Multimodal analgesia, early mobilization with pharmacological and mechanical prophylaxis to reduce venous thromboembolism showed a positive correlation with rapid recovery.

Keywords: Arthroplasty, Replacement, Hip replacement, Knee replacement, THR, TKR

INTRODUCTION

Total hip and knee replacement (THR, TKR) surgeries have become few of the most common and successful surgeries in today's orthopaedics. Although joint replacement has become a routine surgery, it is a significant event in a patient's life. This would naturally demand for a quicker recovery. These surgeries induce a physiological stress, causing an inflammatory cascade of events which may result into postoperative complications and prolonged recovery.[1,2] This has motivated surgeons all over the world to devise protocols for rapid recovery in such patients. As a result, over the past two decades, various pre-, intra-, and post-operative protocols have been developed and are continuously been refined. These enhanced recovery (ER) programmes have been implemented for various elective surgeries.[3,4] Bozic et al conducted a large retrospective study of total joint replacement, in which standardised perioperative care correlated positively with reduced complications and length of hospital stay.[5] Raphael et al in 2011 conducted a study which proved that there is a good strength of evidence supporting these interventions and they allowed the patient to be discharged in two days.[6] This study reviews various such interventions which would give a rapid recovery to these patients.

PRE-OPERATIVE COUNSELLING AND EDUCATION

Educating the patient and relatives about the procedure that they are going to undergo helps to a great degree in the long run. Upon sufficient counselling, patients know the exact pathway to their recovery and understand what

to expect at what stage of their rehabilitation.[7,8] It acts as a tool to align the expectations of the surgeon and the patient and effectively reduce instances of post-operative dissatisfaction.[9] This not just alleviate their anxiety, but also makes them psychologically more confident, which in turn has proven to give a boost to the recovery process.[10-12] Liebergall et al concluded that an emphasis on preoperative education and assessments is one method to decrease hospital stay in elective THR cases.[13] Crowe and Henderson studied the effect of a tailored preoperative rehabilitation programme, including information about the hospital stay, discharge planning, and home preparation.[14] They concluded that these patients rapidly achieved discharge criteria and had shorter hospital stays. Similarly, Daltroy et al noted that preoperative education including psychoeducational preparation also reduced pain medication utilisation.[15]

ANTIFIBRINOLYTICS

Excessive blood loss resulting into anaemia and hypovolemia will cause post-operative complications like nausea, vomiting, positional hypotension, dizziness. This would hamper the rehabilitation process and delay the recovery. This called for an intense research into finding ways to control intra- and post-operative bleeding which has led to the belief that tranexamic acid (TXA) can reduce peri-operative blood loss in elective joint arthroplasties.[12,16] TXA acts through competitive inhibition of lysine binding sites on plasminogen which reduces the local degradation of fibrin clots by plasmin and maintains the clot architecture.[17] However, two things that have shown conflicting results in a wide range of literature are the dose and the route of TXA administration. Although traditionally an intra-venous (IV) dose of 15-20 mg/kg is believed to be an efficient dose, Levine et al demonstrated that a standard dose of 1 g IV can show similar efficiency as weighted doses.[18] Maniar et al conducted a randomized controlled trial of three-dose regimen and postulated that it may be even more effective.[19] An array of such different studies vouches for the efficacy of different doses of IV TXA in reducing transfusion rates and total blood loss.[20] Apart from IV dose, recent studies have shown that an Intra-articular (IA) dose of TXA to be superior as it not only reduces blood loss but also the systemic side effects of TXA. Moreover, IA administration lowers the surgical site inflammation and it does not have any harmful effects on the replaced joint. Patel et al in their study of 89 TKR showed that IV 10 mg/kg of TXA and IA 2 g of TXA were equally effective.[21] Some authors thought of combining the two routes to get the best of both and got good results. Lin et al in 2015, demonstrated greater reduction in blood loss, haemoglobin drop, total drain amount and transfusion rate using a combined protocol compared to IA administration alone.[22] On a similar note, Jain et al got better results in terms of mean total blood loss, transfusion rate and haemoglobin drop, using a combined protocol compared to only IV administration.[23] These advantages invariably reduce the hospital stay and thus also the total cost of the surgery.

SURGICAL DRAINS

Post-operative surgical drains in clean, elective cases do not have an established role. Most studies fail to show a statistical difference in outcome between drained and undrained patients. Despite this, surgeons continue to place drains after elective orthopaedic procedures. Chandratreya et al performed two separate surveys of British orthopaedic surgeons.[24] The first survey noted the incidence of drain use while in the second survey they questioned surgeons about their reasons for drain use. Eventually, they presented the literature and data to the surgeons surveyed. Although the data showed no benefit from drain use, they found that most of the surgeons did not change their practice. This uncovered the reality that drains are continuously being used without any clear clinical evidence. The age-old tendency of using drains depended on the belief that drains reduce tension over the incision, prevents haematoma and thus chances of infection. However, recent trends in total hip and knee replacement have inclined towards operating without the use of drains; reasons being failure of tamponade effect on wound increasing bleeding and thus increasing requirement of post-operative blood transfusion and transfusion related complications.[25] It also increases chances of retrograde infection. A suitable alternative for surgeons favouring drains is alternate clamping and releasing the drain which effectively reduces chances of blood transfusion.[26]

MULTIMODAL ANALGESIA

Pre-emptive analgesia

Pain produced in arthroplasty surgeries can be either - Neurogenic pain, due to the stimulus of the surgical trauma, and Inflammatory pain produced by the cascade of events involving cytokines, prostaglandins, and other pro-inflammatory substances.[27] Pre-emptive analgesia aims to block the events which would cause the inflammatory and neurogenic aspects of post-surgical pain. It tries to prevent or reduce central nervous-system excitability and local wound inflammation.[28] In 2008 and 2011, two randomised controlled trials showed pre-operative cyclooxygenase-2 selective inhibitors to be safe and improved pain and function in TKR.[29,30]

Peri-articular infiltraction analgesia

One of the most important aspects of an enhanced recovery protocol is early mobilization. Since post-operative pain impairs mobility, Local infiltration analgesia (LIA) plays a major role in making early mobility possible. LIA was developed and published in part by Kohan and Kerr in Sydney, Australia, in 2008.[31] The procedure involves infiltration of the surgical site and surrounding tissue with a high volume of a long-acting local anaesthetic like

bupivacaine with or without other adjuvants prior to skin closure. This blocks the local nociceptors for the first 8-12 hours after surgery allowing for same day mobilization and thus a faster recovery, reduction in opioid use and reduced hospital stay.[32] An additional benefit of this technique is its simple procedure with a low side effect profile. Large number of surgeons promote the use of local infiltration in knee replacement surgery with limited evidence supporting its use in hip replacements.[33] Some centres have been using liposomal levo-bupivacaine to prolong the effect up to 48 hours. Adjuvants that are being used along with the anaesthetic agent are ketorolac, clonidine, fentanyl, adrenaline, and cyclocaprone.[34,35] However, there is no strong evidence to prove improved results of a cocktail over individual anaesthetic agent.

Regional anaesthesia

Loco-regional anaesthesia like femoral block or ultrasound guided adductor canal block are simple yet efficient methods of post-operative analgesia in knee arthroplasty patients. These can be done bedside and results in reduction in opioid use post-surgery. However, there have been studies showing that femoral block brings about reduced quadriceps strength by about 15-49% (36,37). This would hinder early patient mobilization. Adductor canal block, on the other hand is a better option as it has a high success rate and has negligible effect on quadriceps function.[36]

Patient controlled analgesia (PCA)

PCA is a system where patients can self-administer predetermined doses of analgesic medication to relieve their pain. After its introduction in 1980s, the use of PCA in hospitals has been increasing greatly. Commonly used drugs are opioids and local anaesthetics. These can be administered intravenously, epidurally, through a peripheral nerve catheter, or transdermally.[38,39] PCA machines contain variables like initial loading dose, demand dose, lockout interval, background infusion rate etc. Morphine is the most studied and most commonly used intravenous drug for PCA. Over non-patient-controlled techniques, PCA has advantages like improved pain relief, greater patient satisfaction, less sedation, and fewer postoperative complications.[40-42]

Observed side effects of opioid-based PCA are nausea and vomiting, pruritis, sedation, urinary retention with respiratory depression and confusion being serious but rare. Judicious use of PCA post THR and TKR surgeries has been proved to be a vital tool in advanced recovery protocol.

Cryotherapy

Application of cold to the skin around the operated tissues not only reduces pain, swelling and inflammation; but also produces vasoconstriction and reduction of neurotransmission which decreases prostaglandin synthesis. This, in turn, supresses pain genesis.[43]

EARLY MOBILISATION AND REHABILITATION

Early mobilisation (day 1) and aggressive physiotherapy are positive predictors for fewer post-operative complications and shorter hospital stay.[44] It is associated with reduced rates of deep vein thrombosis and pulmonary embolism, better circulation, facilitation of gastrointestinal motility, enhancement of pulmonary function, good pain relief and stronger knee function.

The American Academy of Orthopaedic Surgeons (AAOS) recommend early mobilisation as an important mechanical prophylaxis along with chemical agents to reduce chances of venous thromboembolism.[45] Compression stockinette and intermittent compression pneumatic devices are other ways to avoid thrombo-embolic events.

DISCUSSION

There is huge variability in recovery pathways among different institutes and surgeons. One can bring about improvement in the surgical outcome by developing a comprehensive programme to guide the patient throughout the peri-operative period.

Table 1: Proved protocols for enhanced recovery in total hip and knee arthroplasties.

Pre-/intra/post-operative	Protocols
Pre-operative	Patient counselling and education
	Discharge planning
	Pre-medication: cyclooxygenase-2 selective inhibitors
Intra-operative	Regional anaesthesia
	Peri-articular infiltration
	Antifibrinolytics: tranexamic acid
	Avoidance of drain
Post-operative	PCA
	Early mobilisation
	Cryotherapy
	Stockinette and pneumatic compression devices

Combining all these peri-operative protocols have a great positive impact on the recovery of the patient, but the knowing the contribution of each intervention to clinical outcomes is challenging. It is difficult to determine which intervention most or least contributes to patient recovery.[46]

Patient outcome can be improved by modifications in surgical and anaesthetic techniques and nursing protocol changes.[47] Numerous studies have been performed to prove the strength of evidence of individual interventions in the recovery protocol.

Table 2: Strength of evidence for enhanced recovery interventions.

Intervention	Strength of evidence
Patient education	Good
Pre-medication	Weak
Discharge planning	Good
Nutritional screening	Weak
Local infiltration analgesia	Good
Avoidance of surgical drain	Good
Tranexamic acid	Strong
PCA	Weak
Same day mobilisation and aggressive rehabilitation	Good
Chemical prophylaxis for DVT	Weak

CONCLUSION

Enhanced recovery protocols and fast-track surgeries in orthopaedics are becoming popular in more and more institutes. These practices in arthroplasty surgeries involve a comprehensive patient care protocol to guide the patient throughout the peri-operative period. This would involve a consort of multidisciplinary experts including orthopaedicians, anaesthetists, physicians and physiotherapists. There is remarkable evidence to prove that these protocols together improve the surgical outcome to a great extent with early recovery and a satisfied patient.

Recommendations

Do not underestimate pre-operative assessment and counselling. Incorporating a pain control programme to effectively manage peri-operative pain plays a crucial part in early and aggressive physiotherapy and thus, rapid recovery. Peri-articular cocktail infiltration does help in immediate post-surgery pain management and same day mobilisation. A good musculoskeletal physiotherapy team is a must and has a vital role in the post-operative rehabilitation in arthroplasty surgeries. Enhanced recovery protocol in THR and TKR surgeries is a multidisciplinary affair. Devising a standard clinical pathway suitable for your region and institute and based on research always aids for a better outcome.

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