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# An evaluation of a revised analgesia protocol for elective joint arthroplasty

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**Abstract**

*Aims*

Mayo University Hospital performs approximately 350 joint arthroplasty surgeries per annum. We revised our analgesia protocol in 2024 based on best current practice.

*Methods*

We conducted this evaluation from January to July 2025. All patients presenting for joint arthroplasty surgeries were invited to be included.

*Results*

Our evaluation included 147 patients; 94 patients had a total hip arthroplasty and 53 had a total knee arthroplasty. The average age was 69 years, and 142 (96.5%) of patients were living at home independently before surgery. 53 (36%) were on prescribed analgesics pre-operatively. The average pain score on day 1 (day after surgery) was 4.8 for the hip arthroplasty patients and 5.5 for the knee arthroplasty patients. The total oral morphine equivalent requirements for the first 2 days were 48 mgs for the hip surgery patients and 65 mgs for the knee surgery patients. The median length of stay for all patients was 4 days. On follow up at 6 weeks, 135 (91%) of patients were mobilising independently. Overall satisfaction of the patient's experience (0-10) was 8.7 for the knee arthroplasty patients and 8.8 for the hip arthroplasty patients.

*Discussion*

Overall, we were satisfied with our analgesic protocol, but we want to improve the day 1 and 2 pain scores particularly in the knee arthroplasty patients. We are discussing the introduction of adductor canal blocks pre-operatively.

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**Introduction**

Total hip and knee arthroplasty are common major surgical procedures that are often performed in older patients with co-morbid conditions. The most common indication is degenerative joint disease such as osteoarthritis causing pain and disability.

Fast track and enhanced recovery after surgery (ERAS) protocols for hip and knee arthroplasty have developed over the last 25 years.[1] Their aim is to promote faster functional recovery without an increase in morbidity and mortality, while reducing hospital stay, improving patient satisfaction and lowering healthcare costs.[2,3]

Mayo University Hospital (MUH) Orthopaedic department currently performs approximately 350 hip and knee primary joint arthroplasties annually. A fast-track protocol was introduced in Mayo in 2011 following a team visit to the Hvidovre University Hospital in Denmark. The group at Hvidovre University Hospital are renowned for developing and implementing fast-track joint arthroplasty surgery including day case arthroplasty.[4]

The initial protocol introduced in Mayo was adopted from one used at that time in Hvidovre University Hospital.[5] The protocol is detailed in Table 1. This protocol included multimodal analgesia, early mobilisation and other clinical and organisational aspects of fast-track total hip and knee arthroplasty improving all aspects of the perioperative hospital stay.

Length of stay was not the key parameter except as an indicator of the success of the protocol allowing the patients to reach the same functional milestones required to allow discharge. Prior to the introduction of the fast-track protocol in 2011, the average length of stay was 9.5 days for both hip and knee joint arthroplasty. An audit of our joint arthroplasties for the first 4 months after the introduction of the protocol (July to October 2011) showed a reduction in length of stay to 5.4 days. A subsequent re- audit in 2017 showed an average length of stay of 4.4 days.

In 2024, we updated our fast-track protocol to our current one detailed in table 2. The changes included omitting gabapentin which is no longer recommended for acute pain and the replacement of celecoxib with ibuprofen to avoid cardiovascular side-effects. This evaluation aimed to assess the effectiveness and success of the latest update to this protocol in 2024. In addition to examining the compliance with our protocol and patient characteristics, we also measured the day of mobilisation, pain scores on day 1 and 2, length of hospital stay, total analgesia required and a global satisfaction at 6 weeks post operatively. We also focussed on patients who were on pre-operative prescription pain medication and their post-operative course.

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**Methods**

All patients presenting for elective hip or knee arthroplasty were invited to take part in our evaluation. Ethical approval was obtained from the research and ethics committee at Mayo University Hospital

This evaluation monitored patient satisfaction, as well as length of hospital stay, pain levels over the first 48 hours and time to first mobilisation. This was followed up by a phone call to the patient six weeks into their recovery to determine patient satisfaction and functional outcome. Although this protocol had been well implemented throughout the hospital, some omissions of medication were necessary, this was noted on the patient's file along with the reason for omission. Pre- and post-operative haemoglobin levels and blood loss were also monitored, as well as whether the patient received spinal or general anaesthesia and whether the patient was admitted day before surgery or the day of surgery. All the above factors and how they pertained to the patient's recovery and satisfaction post-operatively were examined, interpreted, and included in this evaluation.

All patients undergoing total or partial hip or knee arthroplasties from January 2025 to end of June 2025 were eligible to take part in this evaluation. Only one patient declined the invitation.

Patients were met pre-operatively by a member of the team and informed about the audit. Consent was obtained and the attached form was filled out, including the 6 week follow up. The audit proforma used is attached as table 3.

The data collected was then compiled into an excel spreadsheet. Patients were split up into 2 groups based on whether they had a hip or knee arthroplasty.

**Results**

Our audit included 147 patients, 94 patients had a total hip arthroplasty and 53 had a total knee arthroplasty. The ratio of male to female patients was 70 males to 77 females. The average age for all patients was 69 years. The age range for hip arthroplasty was 43 to 92 years of age and for the knee arthroplasty was 50 to 90 years. The majority of patients (142 patients) were living independently at home, 4 patients required help with the activities of daily living and 1 patient lived in a long-term residential centre. Over a third or 36% (n=53) of patients were on prescription analgesic drugs pre-operatively. The average pre-operative haemoglobin was 13.5 g/dL (range 10.2-16.9 g/dL)

Most patients 86.3% (n= 127) were admitted the day of surgery, the remaining 20 patients were admitted the evening before surgery. Spinal anaesthesia was used for 89% (n=131) of patients, the remainder had general anaesthesia. Only 27.2% (n=40) received the full protocol. The most common omission was the pre-operative isotonic drink.

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The average blood loss for hip arthroplasty patients was 213 mls (minimal to 978 mls) blood loss for the knee arthroplasty was minimal due to the use of a tourniquet. The average post-operative haemoglobin was 11.4 g/dL (range 8-14.7 g/dL) for the knee arthroplasty patients and 10.7 g/dL (range 7.1 to 14.9) for the hip arthroplasty patients.

Day of mobilisation was the first post-operative day (day 1) in 93% of patients (n=137) , 8 patients mobilised on day 2 and 2 patients did not mobilise until day 3. The reasons given were pain on commencement of physiotherapy.

The numeric pain rating scale (0-10 scale) for hip arthroplasty patients on day 1 was 4.8 and for knee arthroplasty patients was 5.5.

The average pain scores on day 2 post op were 3.6 for hip arthroplasty patients and 4.2 for knee arthroplasty patients.

The average total oral morphine equivalent requirement post op for days 1 and 2 combined was 48 mgs for the hip arthroplasty patients and 65 mgs for the knee arthroplasty patients.

We examined the patients who required prescribed analgesics pre-operatively to see the average analgesic requirements post operatively. These patients had higher analgesic requirements and pain scores on day 1 and 2 (Table 5).

The length of stay averaged at 4.77 days (3-13 days) for the knee arthroplasty patients and 4.3 (2-13 days) for the hip arthroplasty patients. The median length of stay for both hip and knee patients was 4 days.

On telephone follow up at 6 weeks post operatively, 91% (n=135) were mobilising independently. The overall percentage of patients requiring more than simple analgesics was 21% (n=31).

Patient reported satisfaction from 0-10 was 8.7 for the knee arthroplasty patients and 8.8 for the hip arthroplasty patients , 0 being least satisfied and 10 being most satisfied.

**Discussion**

Our evaluation was conducted to check the efficacy of our revised fast-track analgesic guidelines. Our compliance with our own guidelines was unsatisfactory given that only 27% received the full recommended treatment. The pre-operative isotonic drink was the main omission.

The pain scores on day 1 were 4.8 and 5.5 respectively for the hip and knee arthroplasty patients. Total knee arthroplasty is considered the more painful procedure which is reflected

in the higher opioid consumption over the first 48 hours post-operatively. In the majority of cases, this did not impact on their ability to mobilise and do physiotherapy.

We compared our practice to published guidelines to see if we could improve. The balance is between effective analgesics and early mobilisation and rehabilitation. We follow all recommendations for total hip arthroplasty except the addition of a fascia-iliac block or local infiltration.[6] Our protocol was for total knee arthroplasty had all the recommendations from the Prospect working group except the addition of a single shot adductor canal block pre-operatively or in the event that this cannot be done, then intrathecal morphine 100 mcg is recommended.[7]

We were pleased with the satisfaction score we received for the overall care and the fact that 91% (n=135) of the patients were mobilising independently at 6 weeks. There was a reduction in the percentage of patients requiring prescription analgesics post operatively 21% (n=31) compared to 36% (n=53) pre-operatively. It is hoped that these patient would continue to wean their opioid use over time.

Further education for all staff is required to ensure better compliance with our own guideline. We hope to introduce a sticker that can be put in the drug prescribing chart and signed easily on the morning of surgery to improve our pre-emptive prescribing of paracetamol, ibuprofen and the isotonic drink.

Based on the relatively high pain scores post operatively, the prescribing of opioid analgesia post-operatively has been changed from a rescue medication to a regular medication to be administered twice daily (short acting oxycodone 10mgs) for the first 48 hours. The PROSPECT guidelines do not recommend regular prescribed opioids but in discussion with the nursing staff this change to regular opioids was implemented as patients often didn't request the rescue analgesia until their pain became severe. Additionally, high demands on staff means that administration of rescue opioids as required cannot always happen in a timely fashion particularly at night. The regular opioid is only given for a 48 hour time period post-operatively and then reverted to a prn prescription.

The knee arthroplasty patients also complained of higher pain scores and required more opioids in the first 48 hours. We are considering the introduction of a single shot adductor canal block to be given pre-operatively to these patients.

In conclusion we were satisfied with our evaluation given the satisfaction scores at 6 weeks, the high percentage of patients mobilising independently and the reduction in prescribed analgesics post-operatively.

We plan on improving patient education at the pre-assessment clinic so patients are aware of the significant post operative pain that they may experience. We will continue to review our analgesic protocol and review the prescribing of regular opioids for 48 hours post-op for the

total knee arthroplasty patients. We plan on introducing an adductor canal block for total knee arthroplasty patients following discussion with our surgical colleagues and will re-evaluate our practice once this is established.

**Declarations of Conflicts of Interest:**
None declared.

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**Appendix:**

***Table 1:*** *Original fast-track protocol introduced in 2011.*

| | |
|---|---|
| Pre-operative | Detailed information to patients and relatives at a pre-op multidisciplinary patient clinic on hospital stay, nursing, pain treatment and functional discharge criteria<br><br>Assessment by anaesthesiology, physiotherapy, occupational therapy, social work and nursing |
| Day of Surgery | Specialised ward where all THR, TKR are admitted. Dedicated staff Physiotherapy available once a day at weekends.<br><br>Day of surgery admission (some exceptions- Type 1 and 2 diabetes)<br><br>Pre-emptive analgesia - paracetamol 2 grams, celecoxib 400mgs (unless contra-indicated), gabapentin 600mgs, and isotonic drink 400mls.<br><br>Neuraxial anaesthesia exclusively, avoidance of opiates, benzodiazepines<br><br>Intra-operatively- high dose glucocorticoids (methylprednisone 125mgs, tranexamic acid 1 gram iv unless contra-indicated)<br><br>LIA (local infiltration technique) for total knee arthroplasty LIA (Ropivacaine 200ml bag which contains 400mgs of ropivacaine with 1 mg adrenaline, and clonidine |

| | |
|---|---|
| | 150mcgs added. 120-150 mls of this mixture is used)<br><br>Avoidance of surgical drains<br><br>Opioids (oxycodone 5-10mgs po ) given in recovery room |
| Post operative | DVT prophylaxis<br><br>Physiotherapy<br><br>Multimodal analgesia-paracetamol 1 gram every 6 hours, celecoxib 200mgs bd for 5 days, gabapentin 600mgs bd for 7 days. Opioids (oxycodone) only on request. Anti-emetics and laxatives prescribed.<br><br>Discharge criteria- patients independent regarding personal care, able to walk with crutches, able to get in and out of bed and into and up from a chair. Sufficient pain treatment and accepting discharge. |

***Table 2:*** *Fastrack protocol introduced in 2024- changes from 2011 protocol are in bold*

| | |
|---|---|
| Pre-operative | Detailed information to patients and relatives at a pre-op multidisciplinary patient clinic on hospital stay, nursing, pain treatment and functional discharge criteria<br><br>Assessment by anaesthesiology, physiotherapy, occupational therapy, social work and nursing |
| Day of Surgery | Specialised ward where all THR, TKR are admitted. Dedicated staff Physiotherapy available once a day at weekends.<br><br>Day of surgery admission (some exceptions- Type 1 and 2 diabetes)<br><br>Pre-emptive analgesia - paracetamol 2 grams, ibuprofen 400mgs (unless contra-indicated)and isotonic drink 400mls.<br><br>Neuraxial anaesthesia exclusively, avoidance of opiates, benzodiazepines<br><br>Intra-operatively- high dose glucocorticoids methylprednisone 125 mgs, 1 gram tranexamic acid iv unless contra-indicated<br><br>LIA (local infiltration technique) for total knee arthroplasty (Ropivacaine 200ml bag which contains 400mgs of ropivacaine with 1 mg adrenaline, and clonidine 150mcgs added. 120-150 mls of this mixture is used)<br><br>Avoidance of surgical drains<br><br>Opioids (oxycodone 5-10mgs po) given in the recovery room |
| Post operative | DVT prophylaxis |

| | |
|---|---|
| | Physiotherapy<br><br>**Multimodal analgesia-paracetamol 1 gram every 6 hours, ibuprofen 400mgs every 8 hours (unless contra-indicated). Opioids (oxycodone) only on request.**<br><br>Anti-emetics and laxatives prescribed.<br><br>Discharge criteria- patients independent regarding personal care, able to walk with crutches, able to get in and out of bed and into and up from a chair. Sufficient pain treatment and accepting discharge. |

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***Table 3***

Elective Joint Arthroplasty Audit

| |
|---|
| |

Patient's contact number for follow up _____

Consent obtained

| |
|---|
| |

Patient age _____

M / F

**Independence prior to surgery** (please circle)
fully independent yes / no
needs help with ADL's yes/no

Use of walking aid yes / no

**Medication taken for analgesia pre surgery**

| |
|---|
| |

**Place of residence**
Home
Nursing Home
Long term facility

**Joint replaced**

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Hip / Knee
Left / Right

Date of surgery --/--/2025

Admitted day or surgery or day before __/__/2025

**Hb pre-op** ___ g/dL

**Anaesthesia**
GA. / Spinal
**Blood loss in mls**

**Hb post op** g/dL

**Fast track meds given**
Paracetamol
Ibuprofen
Pre-op drink

**Intra op**
Methylpredisone
Tranexamic acid

**Post op**
Oxynorm in recovery room
5mgs/10mg

**Analgesia post op prescribed**:
Paracetamol / ibuprofen
Total oxynorm required

Pain score day 1 post op

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Pain score day 2 post-op

Was physiotherapy delayed due to pain?

Day of mobilisation

Day of discharge

**Follow up at 1 month**
Analgesia required at that time
Mobilising independently
Using walking aid

**Overall satisfaction with care**
1-10

***Table 4:*** *Patient demographics and results*

| | Hip arthroplasty | Knee arthroplasty |
|---|---|---|
| Total no. of patients in audit | 94 (64%) | 53 (36%) |
| Average age | 69 yrs | 69 yrs |
| Male: Female ratio | 44:50 (49%:51%) | 26:27 (46%:54%) |
| Independent at home | 91 (96.8%) | 51 (96%) |
| Pre-op Hb (g/dL) | 13.5 (+/- 1.5) | 13.6 (+/- 1.5) |
| On prescribed analgesics Pre-op | 35 (37.2%) | 18 (33.9%) |
| Day of surgery admission | 79 (84%) | 48 (90.5%) |
| Spinal anaesthesia | 86 (91.4%) | 48 (90.5% ) |
| Post op Hb (g/dL) | 10.7 (+/- 1.4) | 11.4 ( +/- 1.7) |
| Day of mobilisation | 87/94 (92%) on Day 1 | 50/53 (94%) on Day 1 |
| Pain score Day 1 (0-10) | 4.8 +/-2.4 | 5.5 +/- 2.7 |
| Pain score Day 2 (0-10) | 3.6 +/-2.3 | 4.2 +/-2.4 |
| Length of hospital stay | 4.3 (2-13 days) | 4.7 (3-13 days) |
| Mobilising independently at 6 weeks | 85 (90%) | 50 (94%) |
| Requiring prescribed analgesics at 6 weeks | 17 (18%) | 14 (26%) |
| Satisfaction at 6 weeks (0-10) | 8.8 (range 4-10) | 8.7 (range 3-10) |

***Table 5:*** *Comparison between patients on prescribed analgesics and simple analgesics pre-operatively*

| | Prescribed analgesics pre-op | Simple analgesics pre-op |
|---|---|---|
| Knee arthroplasty | 14 (33.9%) | 39 (66.1%) |
| Hip arthroplasty | 17 (18%) | 77 (82%) |
| Total morphine requirement for Day 1 and 2 Knee arthroplasty | 66 mgs | 64 mgs |
| Pain score Day 1 post knee arthroplasty | 4.7 | 6.0 |
| Pain score Day 2 post knee arthroplasty | 4.6 | 4.1 |
| Total morphine requirement for Day 1 and 2 Hip arthroplasty | 53 mgs | 45 mgs |
| Pain score Day 1 post hip arthroplasty | 5.2 | 4.6 |
| Pain score Day 2 post hip arthroplasty | 4.0 | 3.8 |