

Intraoperative nociception monitoring and postoperative recovery after knee arthroplasty

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Aim of investigation : Although the clinical benefits of total knee arthroplasty (TKA) are acknowledged, chronic neuropathic pain may develop postoperatively which might be challenging to treat once established. Intraoperative nociceptive stimuli may contribute to central nervous system sensitization and thereby to enhanced postoperative pain and perhaps persistent pain. NOL (Nociception Level) index, derived from the PMD-200 (Medasense Ltd.) is a multidimensional noninvasive tool to assess nociception. NOL index has been validated intraoperatively with the aim to tailor intraoperative analgesics use (Edry et al, Anesthesiology 2016). The motivation of this observational study was to assess the potential correlation between the intraoperative NOL index, and postoperative recovery after knee arthroplasty (TKA).

Methods : After ethical committee approval and informed consent, 75 adult patients scheduled for elective TKA performed by a single surgeon were included. All the patients were part of a rapid recovery programme with standardized perioperative management. TKA was performed under general anesthesia with local knee infiltration. Intraoperative NOL index values (0= no nociceptive response, 100=maximal nociceptive response) were recorded independently of intraoperative anesthesia management. Intraoperative nociception level was defined as AUC for NOL index >20 or >30 (nociception threshold) divided by total operative time (Figure 1). Intraoperative NOL was correlated with postoperative pain scores (NRS, 0 to 10) during PACU stay, at rest, at mobilization and during night on day1 and day2, and with 3 months patient's recovery assessed by pain during mobilization and by functional Forgotten Joint Score (FJS; Carlson et al, J Arthroplasty 2018). Statistical analysis used paired t-tests, Pearson's and Spearman's correlations, $P < 0.05$ was significant.

Results : 75 patients, age 65 ± 9 yrs, females/males ratio: 49/26, underwent TKA resulting in 3 months improvement for knee pain at mobilization (pre- vs postoperative NRS, 7 (6-9) vs 3 (1-4), $p=0.003$) and knee function assessed by FJS (pre- vs postoperative FJS, 9.5 (2-25) vs 41.5 (27-69), $p < 0.001$). Baseline median NOL index was 13 (IQR 8-18). Intraoperative

nociceptive response was defined as AUC NOL index >20 (median value 1.8, IQR 0.8-3.7) or AUC NOL index >30 (median value 0.3, IQR 0.3-2.6) did not correlate with PACU pain scores but respectively correlated with pain at mobilization at day 1 ($R=0.255$, $P=0.045$; $R=0.246$, $P=0.033$) and pain at movement at 3 months ($R=0.317$, $P=0.025$; $R=0.283$, $P=0.046$).

Conclusion : Given the expanding role of knee arthroplasty and the need to facilitate an earlier hospital discharge, improving postoperative pain control has become an increasingly important issue for all anesthesiologists. The presented results show that control of intraoperative nociception (assessed by NOL index) is important as it may predict early and longer term postoperative pain.

In addition, recent work (by Edry et al, *Anesthesiology* 2016) demonstrated that during surgery, assessment of nociception (NOL index) may also help to manage analgesics use, where these conclusions may infer that NOL guided analgesic administration improve patient outcome (to be investigated).

Figure 1: Intraoperative nociception level defined as area of NOL values above threshold (20 or 30) divided by total surgical time.

