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Title: Does the response to IV cannulation predict post-operative pain?

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Introduction: High levels of post-operative pain increase the risk a patient might develop chronic pain, increase length and cost of hospital stay, and increase the risk of post-operative adverse events, such as thromboembolism. One goal of anaesthetic care is to minimize the levels of pain people experience following their operation. A significant body of research has investigated whether high post-operative pain can be predicted, including looking at age, gender, operation type and psychological factors, pre-operative physiological tests involving stimuli such as electricity and temperature, and routine pre-operative anaesthetic procedures.

Aim: To determine whether pain responses to two routine pre-operative procedures, IV cannulation and a premedication dose of propofol, can predict post-operative pain.

Impact: If we can predict post-operative pain levels based on the pain responses to routine pre-operative procedures, we will have a useful method of identifying those patients more at risk of developing higher levels of post-operative pain, and will be in a better position to be able to manage their pain levels more effectively.

Method: 60 consenting patients undergoing laparoscopic surgeries were recruited at Christchurch Hospital between November 2017 and January 2018. Pain scores where obtained pre-operatively, using a visual analogue scale (VAS). Here patients indicated, by drawing on a 100mm line, the extent to which they experienced pain (with "no pain" and "worst possible pain" at either end). Pain during two routine pre-operative procedures was assessed – on IV cannulation and on injection of propofol (30mg). As lignocaine was routinely given as part of the IV cannulation procedure, a third data point of pain on lignocaine injection was taken when it occurred. The medications given during the operation and in recovery were recorded, noting time of administration and dose administered. We were able to model fentanyl, an analgesic medication routinely given as part of anaesthetic care, to determine predicted fentanyl levels at key time points (in particular: when ready to leave the operating theatre, and when ready to leave the recovery room), allowing fentanyl levels to be used as a proxy pain measurement. VAS pain scores were also obtained throughout the stay in recovery, taken on at least three occasions. Data were analysed with Prism.

Results: Highest pre-operative pain scores were compared with highest post-operative pain scores and with fentanyl levels on discharge from recovery, both comparisons showing no significant correlation ($r^2 = 0.063$, $p = 0.06$; $r^2 = 0.0072$, $p = 0.53$). To compare the pain scores of those with the most elevated highest pre-operative pain responses ('pain responders') with the pain scores of those with less elevated highest pre-operative pain responses ('non pain responders'), the results were stratified at the 75^{th} percentile mark. At such a cutoff, pain responders had highest pre-operative pain scores over 50, and non pain responders 50 and below on the VAS. There was no significant difference between these two groups with respect to highest post-operative pain score and to fentanyl levels on discharge from recovery (Mann-Whitney U test; $U = 256$, $p = 0.17$; $U = 281.5$, $p = 0.34$).

Mean inter-operative fentanyl levels and fentanyl levels on discharge from recovery did correlate significantly ($r^2 = 0.205$, $p = 0.0004$) – post-operative fentanyl levels were 52.45% the level of mean intra-operative fentanyl levels.

Lignocaine as part of the IV cannulation procedure was used with the majority of participants (80%). The pain score on injection of lignocaine contributed to the analyses of highest pre-operative pain scores. Lignocaine was also used with the premedication propofol injection (52% of the time).

Conclusion: This study was unable to replicate the results of previous studies using response to routine pre-operative procedures to predict post-operative pain levels, finding no significant correlation between pre-operative pain measurements and post-operative pain scores and fentanyl levels on discharge from recovery. Using the 75^{th} percentile of highest pre-operative pain scores as a cutoff point, no significant difference between pain responder group and non pain responder group was found. However, the intraoperative fentanyl level did predict how much fentanyl was required in recovery, as indicated by the significant correlation between average intra-operative fentanyl levels and fentanyl levels on discharge from recovery.

While the use of lignocaine pre-operatively may be contributing to the results of this study, its use was not actively discouraged as it was considered to be part of routine pre-operative procedure.

Given the results, it is likely that the pre-operative routine procedures employed as part of this study are not predictive of post-operative pain. Further investigation of the groups of patients with high pain scores pre- and post-operatively is warranted to determine whether there are any characteristics of these groups that could be used predictively (i.e. psychological profile). It would also be worthwhile to look in more detail at pre-operative physiological testing, to determine whether this may yet have predictive value. In particular, further investigation of the cold pressor test as a pain stimulus, whereby patients' tolerance and experience of pain with low temperature is utilized as an assessor of responsiveness to pain, may be useful.