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Calculating positive and negative predictive values. Comment on *Br J Anaesth* 2021; 126: 564-7

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Keywords: Bayesian inference; negative predictive value; positive predictive value; prior probability; statistics

Editor—We read the editorial by Hadjipavlou and colleagues[1] entitled 'What is the true worth of a p-value? Time for a change' with great interest. We share the concern of the authors regarding the use of statistics in biomedical science. In their paper, the authors show the worth of a study's conclusion by calculating positive and negative predictive values (PPV and NPV, respectively) using equations given in their Table 1. Such calculations were reported earlier by others including Ioannidis,[2] who refers to earlier work in his paper. The calculations are founded on contingency tables and Bayesian inference.

When comparing the papers from Hadjipavlou and colleagues[1] and Ioannidis,[2] we encountered several discrepancies. In short, when recalculating PPV and NPV using a power of 0.8, α=0.05, and prior probability of 50%, we obtained values of 94% and 83%, respectively, whereas the editorial reports the reverse values, that is 83% and 94%. To gain understanding of the entries in Table 1 of Hadjipavlou and colleagues,[1] the following definitions and derivations may be helpful.

The PPV=$P(E|+)$ is the probability that there is an effect (E) given a positive outcome of an experiment (+); the NPV=$P(\neg E|-)$ is the probability that there is no effect ($\neg E$) given a negative outcome of an experiment (−). The type I error rate $\alpha=P(+|\neg E)$ is the probability of a positive outcome when there is no effect, and $P(-|\neg E)=1-\alpha$; the type II error rate $\beta=P(-|E)$ is the probability of a negative outcome when there is an effect, with power=$1-\beta=P(+|E)$. Here, the null hypothesis is that there is no effect. Furthermore,

$$P(+)=P(+|E)\cdot P(E)+P(+|\neg E)\cdot P(\neg E) \text{ and } P(-)=P(-|E)\cdot P(E)+P(-|\neg E)\cdot P(\neg E)$$

where $P(E)$ is the *a priori* probability of effect, and $P(\neg E)=1-P(E)$.

Using Bayes' theorem, the PPV and NPV can be calculated as

$$\text{PPV}=P(E|+)=P(+|E)\cdot P(E)/P(+)=\text{power}\cdot P(E)/(\text{power}\cdot P(E)+\alpha\cdot(1-P(E)))$$

$$\text{NPV}=P(\neg E|-)=P(-|\neg E)\cdot P(\neg E)/P(-)=(1-\alpha)\cdot(1-P(E))/((1-\alpha)\cdot(1-P(E))+\beta\cdot P(E))$$

from which it may be inferred that for example A in the authors' Table 1 would be A=power·$P(E)$. When the prior $P(E)$=0.5, the equations simplify to (see also Heston and King[3])

$$\text{PPV}=\text{power}/(\text{power}+\alpha) \text{ and } \text{NPV}=(1-\alpha)/(1+\beta-\alpha)$$

We hope that this analysis sheds some light on the calculation of PPV and NPV. As the authors discuss, the PPV and NPV do not only depend on the P value, but also on the power of a study, and the prior probability. Assessing their interdependencies may indeed be valuable when designing a study. Finally, it is important to keep in mind that powering a study on desired PPV and NPV and possibly biased prior belief may suggest a possibly downward biased sample size.

Declarations of interest

The authors declare that they have no conflicts of interest.

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Posterior femoral cutaneous nerve block improves regional anaesthesia for below-knee surgery

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Keywords: orthopaedic surgery; peripheral nerve block; posterior femoral cutaneous nerve; quality; regional anaesthesia

Editor—We read with great interest the article by Feigl and colleagues,[1] who reported a significant role of the posterior femoral cutaneous nerve (PFCN) in regional anaesthetic block techniques for surgical procedures distal to the popliteal region. So far, to our knowledge, there is no clinical report describing the importance of the PFCN block for below-knee surgery. We hypothesised that the PFCN block, when combined with femoral and sciatic nerve blocks, would improve regional anaesthesia for below-knee surgery.

In our institution, ultrasound-guided peripheral neural block (PNB) combined with laryngeal mask general anaesthesia is the routine practice for lower-extremity surgery. From March 2020, ultrasound-guided single-shot PNB with PFCN block has been used as sole anaesthesia for below-knee surgery. In practice, anaesthetists discuss with patients (or their relatives) whether to combine general anaesthesia with PNBs or not before obtaining written consent. On arrival in the operating theatre, sufentanil 5 μg or fentanyl 50 μg was administered i.v. to ameliorate pain associated with neural block. After femoral nerve block, the patient was turned to the lateral position with the surgery side up. A linear probe was placed cephalic and parallel to subgluteal crease.[2] The PFCN is medial and superficial to sciatic nerve (Fig. 1). Using an in-plane approach, a total of 20 ml of ropivacaine 0.5% was injected for both nerves, with the proportion used for each nerve at the anaesthetist's discretion, as was the use of dexmedetomidine or additional opioids during the procedure. After surgery, patients left the operating theatre directly back to their wards bypassing the recovery room.

There were 45 consecutive patients undergoing PNBs as sole anaesthesia for their 57 surgical procedures. None converted to general anaesthesia. The patient characteristics and operative information are listed in Table 1. Seven patients had repeated operations, and one patient had six repeated operations under PNBs. All patients were satisfied with the anaesthesia provided. No patient requiring repeated surgery requested the addition of general anaesthesia for their subsequent procedures.

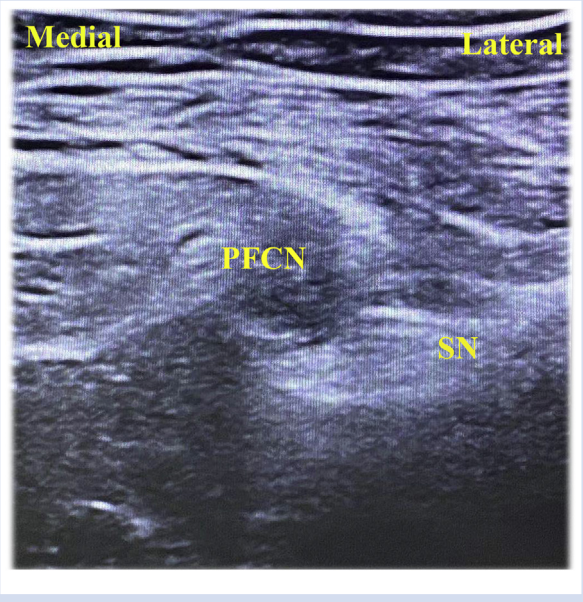

Fig 1. Ultrasound image of PFCN and SN at the subgluteal crease. PFCN, posterior femoral cutaneous nerve; SN, sciatic nerve.

The use of PNB for lower-extremity surgery is not as frequent as in the upper extremity. One possible reason is the uncertainty of anaesthesia quality. A previous report revealed that the failure rate of triple nerve block (tibial, common perineal, and saphenous nerve) at the knee for foot and ankle surgery was ~10%.[3] Another study found that PFCN block was not useful for tourniquet tolerance compared with popliteal sciatic nerve block for below-knee surgery, mainly foot and ankle surgery.[4] According to Feigl and colleagues,[1] nearly half of PFCNs examined terminated at the distal lower leg; therefore, PFCN block