also investigated the relationship between changes in HR with and/or autonomic function associated with morbidity after surgery.

We conducted a *post-hoc* analysis of HR data obtained in a prospective observational cohort study of patients ≥18 yr in whom serial Holter-based measurements of cardiac autonomic activity were made before, and for 48 h after, surgery. The primary outcome was absolute discharge HR (beats min^{-1}), recorded at rest before hospital discharge. We examined the association between quartiles of discharge HR and autonomic measures (time/frequency domain heart rate variability) associated with morbidity (defined by postoperative morbidity survey).

In 157 patients (66 [42%] male; age 67 [9] yr), HR at hospital discharge (range, 53–122) increased by 5 beats min^{-1} (95% confidence interval [CI], 3–7; $P<0.001$) compared with preoperative values. Patients in the upper quartile of discharge HR (≥85 beats min^{-1}) were more likely to sustain pulmonary (odds ratio [OR]=2.18; 95% CI, 1.07–4.44; $P=0.03$) and infectious (OR=2.31; 95% CI, 1.13–4.75; $P=0.02$) morbidity within 7 days of surgery, compared with lower quartiles (Fig. 5). Pulmonary/infectious morbidity was associated with loss of cardiac vagal activity.

HR on discharge from hospital after major elective noncardiac surgery is frequently elevated and is promoted by morbidity associated with reductions in cardiac vagal activity.

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Comparison of the learning curves of novice anaesthetists using needle tip tracking during simulated ultrasound-guided sciatic regional nerve block on the soft embalmed Thiel cadaver

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Increased demand exists for regional anaesthesia, but the incidence of nerve injury remains unchanged despite the use of ultrasound.[1] The precise location of the needle tip is difficult to see using current technology.[2] A new tip tracking needle has a piezo element embedded onto the needle shaft 3 mm from its tip. The system allows primary identification of the needle tip within a green circle rather than the needle shaft. In a recent pilot study of eight volunteers, we showed better performance using needle tracking technology while conducting sciatic block on Thiel cadavers.[3] We wished to repeat the pilot study and recruit medical students without experience of ultrasound alongside a wider range of anaesthetists. Our primary objective was to determine whether volunteers were able to identify the needle tip better when the piezo was activated. Secondary objectives were to measure psychometrics and cognition and capture focused attention using eye tracking.

Table 1 Steps, errors and eye tracking results with tracker on and off.

	Tracker on	Tracker off	
	Med IQR	Med IQR	
Duration of task (sec)	22.2 (18.1–34.2)	31.0 (20.8–36.8)	0.01
Fixations (overall) (number)	20.5 (15.5–29.0)	25.2 (18.7–36.9)	0.005
Duration (at monitor) (sec)	20.0 (16.7–31.8)	23.4 (19.7–34.8)	0.002
Fixations to monitor (number)	19.8 (13.9–26.0)	23.7 (16.0–34.8)	0.002

Forty volunteers repetitively conducted mid-thigh sciatic block for 2 h on 6-month-old Thiel cadavers at the Centre for Anatomy and Human Identification, University of Dundee. All underwent cognitive skills testing and sciatic block training on pig phantom and Thiel cadaver followed by testing on a separate cadaver. Subjects used an Onvision tip tracking needle and Xperius ultrasound system (both from B.Braun, Melsungen, Germany and Philips, Eindhoven, The Netherlands) with a 2–6 MHz curvilinear transducer. Sciatic block was performed twice with the tip tracker on and twice with the tracker off, and the process repeated for 2 h. Subjects were randomised using a computer programme to two study starting points—tracker off or on. All subjects wore eye tracking glasses and all blocks were filmed using two cameras. Research software was used to remove the coloured circle from the ultrasound image to allow blinded analysis of tasks and errors. Within subject data was analysed using the Wilcoxon test. Correlated proportions were analysed using McNemar's test.

We present results from 36 subjects (Table 1). There was no difference in psychometric or cognitive scores between groups. Eight tasks improved and seven errors reduced using the tracker needle. With the activated needle, tasks took longer ($P=0.01$), and overall fixations were longer ($P=0.03$).

In conclusion, needle tip technology improved the performance of volunteers conducting sciatic block on the Thiel cadaver.

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Randomised placebo-controlled trial of continuous sciatic or posterior tibial nerve blockade on pain after major lower limb amputation

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Persistent pain after major lower limb amputation is common, with an incidence of up to 80%.[1] Once established, phantom limb pain is very difficult to treat and can have a significant adverse effect on quality of life and rehabilitation.[2] Several techniques including regional anaesthesia, nerve stimulation, ketamine, or nerve stump infiltration with local anaesthetic have been investigated for the prevention or alleviation of long-term pain after amputation, but the data are conflicting and most studies have been very small.[3]

The aim of this randomised placebo-controlled double-blind study was to compare the effect of a continuous perineural infusion for 96 h of levobupivacaine 0.125% (Group L) with saline placebo (Group S) on pain after major lower limb amputation. The primary outcome measure was the presence (or absence) of moderate or severe phantom limb pain at 6 months. Hospital Anxiety and Depression Scores (HADS), Geriatric Depression Scores (GDS), and McGill pain questionnaire and other data were collected.

Ninety patients were randomised and data from 81 patients (51 males) were analysed. All patients had critical limb ischaemia, underwent amputation under a standardised general anaesthetic and received morphine patient-controlled analgesia (PCA) for 48 h after surgery. Any patient reporting severe pain at rest or symptoms of phantom limb pain received gabapentin up to 1.8 g daily. Data were analysed using Kruskall–Wallis and χ^2 tests and mixed linear regression modelling. Mean (range) ages were 71 (41–94) yr and 71.5 (44–90) yr in Group L and Group S, respectively (Table 2).

Pain, HADS, and GDS scores decreased significantly over time, but there were no differences in phantom pain, stump pain phantom sensation, or analgesic requirements between the groups. Phantom pain at 6 months was associated with PCA morphine use before and in the 48 h after surgery. Stump pain at 6 months was associated with preoperative pain and early postoperative PCA morphine use. Phantom and stump pain at 6 months correlated with HADS and GDS scores but with no difference between the groups.

The incidence of phantom limb pain was lower in this study than previously reported, but continuous infusion of 0.125% levobupivacaine had no effect on phantom pain, phantom sensation, or stump pain. Pain scores and analgesic requirement varied widely and depended on preoperative and early postoperative pain and medication. Future studies in this area should stratify for baseline pain.

Table 2 Visual analogue scores (VAS) for pain on movement. Data are incomplete at some time points.

VAS (none/mild/moderate/severe)	Levobupivacaine group (n=41)	Saline group (n=40)
Stump pain before surgery	3/8/7/19	3/9/9/17
Stump pain at 1 week	5/14/12/2	12/13/7/5
Stump pain at 3 months	20/6/5/3	26/5/3/0
Stump pain at 6 months	19/5/3/3	24/5/3/0
Phantom pain at 1 week	21/5/5/1	23/6/5/2
Phantom pain at 3 months	18/8/6/2	18/4/6/0
Phantom pain at 6 months	19/4/1/6	15/7/3/5

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Experimental medicine in anaesthesia-related research: UK and US activity

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Experimental Medicine is defined by the UK Medical Research Council (MRC) as 'Investigation undertaken in humans, relating where appropriate to model systems, to identify mechanisms of pathophysiology or disease, or to demonstrate proof-of-concept evidence of the validity and importance of new discoveries or treatments'.[1] Biomedical advances have transformed the potential for Experimental Medicine undertaken in humans, which is pivotal for new discoveries and treatments. However, current capacity for anaesthesia-related researchers to contribute to the Experimental Medicine agenda is unclear, both in the UK and USA.

Two investigators independently assessed whether UK/USA researchers meet the MRC definition using PubMed, PatentScope, and US National Institute of Health funding databases from January 1, 2014 to May 31, 2019. Clinical trials/outcomes data (including comparison of established biomarkers) were excluded. The primary outcome was number of individuals meeting the MRC definition. Secondary outcomes included funding source and patent registration.

Overall, 35/189 (18.5%) UK researchers produced 181/465 (38.9%) outputs that met the MRC definition; 27/35 (77.1%) were primarily university employed. Five of 35 (14.2%) UK researchers meeting the MRC remit had named patents. Similarly, a minority of US NIH-funded investigators (74/261; 28.4%) met the MRC definition.

A minority of UK- and US-based researchers in anaesthesia-related research are engaged in MRC-defined Experimental Medicine, suggesting a lack of capacity in an area critically dependent on an increasing need for clinician–scientist engagement.[2]

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