Introduction

Regional anaesthesia (RA) is used to delivering anaesthetic around peripheral nerves via a needle to perform nerve blocks for many surgical procedures. RA offers quick patient recovery, lower cost and improved pain management. Peripheral nerve stimulation and ultrasound imaging are used for guiding the needle, but there remains a considerable (10%) chance of nerve damage mainly caused by needle penetrating the nerve. The aim of this paper is to identify the fascicles (bundles of nerve fibres) using microultrasound imaging (frequencies greater than 30 MHz), validate these findings with histology, and identify changes in the nerve caused by the needle penetration.

Materials and Methods

The nerve specimens used were dissected from Thiel embalmed human cadavers and fresh cadavers. Microultrasound images of the nerves were obtained by scanning the specimens with high frequency (30 MHz and 40 MHz) transducers. The nerve specimens were fixed and stained for histological processing. RA needles were inserted into the nerve to simulate the clinical problem, and 3D microultrasound images acquired with needles in place and after removal.

Results

The microultrasound imaging was able to visualise the substructures of the nerve showing fascicles of size, o.5 mm diameter and greater. Statistical analysis of the fascicle dimensions along the length of the nerve was done. The anatomical structures were found to be similar in both microultrasound and histology images. The position of needles within the nerves, and fascicles split by inserted needles were easily visualised in the microultrasound images.

Conclusion

The microultrasound results were validated with histology demonstrating its use for studying the morphology of peripheral nerves. The needle insertion pilot study indicated that there is mechanical damage caused when the needle was inserted within and without the fascicles.