The Use of Local Analgesic Agents in Scoliosis Surgery

The Implications for Spinal Cord Monitoring

Bernadette Ann Loughnan

BSc MB ChB FRCA

A Thesis Submitted for the Degree of Doctor of Medicine

University of Auckland

1993

ABSTRACT

The thesis examines the use of local analgesics as part of the anaesthetic technique for scoliosis surgery. Any agents used must have minimal interference with monitoring of spinal cord integrity.

The literature on the anaesthetic requirements for scoliosis surgery is reviewed and the various methods of monitoring spinal cord function are discussed.

The historical background and experimental rationale for the use of the somatosensory evoked potential (SEP) in scoliosis surgery is examined. The advantages of the epidural SEP over the scalp-recorded SEP are demonstrated. Spinal cord monitoring at many UK centres consists of measuring the SEP recorded from the C_7 - T_1 epidural space to stimulation of the posterior tibial nerve (PTN) at the popliteal fossa.

The effects of a lumbar epidural injection of different local analgesic solutions on the SEP to posterior tibial nerve stimulation were investigated. In the initial study, epidural lignocaine 2% 10 ml was evaluated. The next two experiments assessed the changes after epidural diamorphine 0.1 mg kg^{-1} and epidural etidocaine 1% 10 ml respectively on the SEP. The final study compared the effects of epidural bupivacaine 0.25%, 0.5% and 0.75% 10 ml on the SEP.

These studies showed that 10 ml of lignocaine 2%, bupivacaine 0.5% or bupivacaine 0.75% depressed significantly the epidural SEP. Diamorphine 0.1 mg kg^{-1} had no measurable effect. Etidocaine 1% caused a profound decrease, and in some cases an obliteration of the SEP. There was a clear concentration-dependent effect of increasing concentrations bupivacaine on the SEP.

The effects of the different local analgesic agents on the neurophysiological variables are considered in the light of their known physicochemical properties. The literature on the neural generators of the epidural SEP is reviewed. My studies are compared to similar experiments on the scalp-recorded SEP and the SEP to dermatomal stimulation. Possible differences in the epidural SEP between scoliosis and non-scoliosis patients are noted. The possible relevance of the changes in mean arterial pressure when assessing alterations in SEP is examined.

Etidocaine, and local anaesthetics of high lipid solubility, have no place in anaesthesia for scoliosis surgery. Furthermore, lignocaine 2%, bupivacaine 0.75% or bupivacaine 0.5% cannot be recommended because they interfere with monitoring of the SEP in the perioperative period. However, lower concentrations of bupivacaine such as 0.25%, together with diamorphine 0.1 mg kg^{-1}, may be appropriate, since they have minimal effects on the SEP.

ACKNOWLEDGMENTS

I wish to acknowledge the staff of the Royal National Orthopaedic Hospital, Stanmore, Middlesex for their help, but most particularly the Scoliosis Surgeons for their patience and Mr. John Farrell of the Medical Physics Department for technical assistance. I also thank the North West Thames Regional Health Authority for an equipment grant which enabled me to complete the work at Northwick Park Hospital. Finally, I wish to acknowledge the help and guidance given to me by Professor George Hall of St. George's Hospital London (formerly of the Hammersmith Hospital), without whom this work would not have been possible.

LIST OF PUBLICATIONS

The following is a list of publications on work which is described in the thesis.

Loughnan, B.A., M.E. Fennelly, M.A. Hetreed, & G.M. Hall, 1991. 'Effect of varying concentrations of bupivacaine on the somatosensory evoked potential to posterior tibial nerve stimulation'. *Acta Anaesthesiol. Scand.* v.36, S96, p.179.

Loughnan, B.A., L.J. Murdoch, M.A. Hetreed, L.A. Howard, & G.M. Hall, 1990. 'Effects of 2% lignocaine on somatosensory evoked potentials recorded in the extradural space'. *Br. J. Anaes.*, v.65, pp.643-47.

Loughnan, B.A., K.W. Yau, A.O. Ransford, & G.M. Hall, 1991. 'Effects of epidural diamorphine on the somatosensory evoked potential to posterior tibial nerve stimulation'. *Anaesthesia*, v.46, pp.912-4.

Loughnan, B.A., S.M. McHale, K.R. Welsh, & G.M. Hall. 'Etidocaine and epidural somatosensory evoked potentials after posterior tibial nerve stimulation'. *Submitted to Br. J. Anaes.*

TABLE OF CONTENTS

CHAPTER III - METHODS

CHAPTER IV - EFFECT OF LIGNOCAINE ON THE EPIDURAL SEP

CHAPTER V - EFFECT OF DIAMORPHINE ON THE EPIDURAL SEP

FIGURES

TABLES