

PAEDIATRIC REGIONAL ANAESTHESIA: A CLINICAL ANATOMICAL STUDY

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Supervisors: Prof MC Bosman

Prof AT Bosenberg



Declaration of Original Work

A van Schoor	Date
any academic award to any other tertiary institution	
Philosophy in Anatomy, is my own original work	-
Which I herewith submit to the University of Pre	etoria for the Degree of Doctor of
"Paediatric Regional Anaesthesia – A Clinical A	Anatomical Study"
I, Albert-Neels van Schoor, hereby declare that this	s thesis entitled,



Foreword and acknowledgments

This study could not have been possible if not for the help and support of so many people in my life. I thank God for giving me the ability to undertake such a project, but also for the family, friends and dear colleagues that played such a vital role in my life.

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Summary

Paediatric Regional Anaesthesia: A Clinical Anatomical Study

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In 1973, Winnie and co-workers stated that no technique could truly be called simple, safe and consistent until the anatomy has been closely examined. This is evident when looking at the literature where many anatomically based studies regarding regional techniques in adults have resulted in the improvement of known techniques, as well as the creation of safer and more efficient methods. Anaesthesiologists performing these procedures should have a clear understanding of the anatomy, the influence of age and size, and the potential complications and hazards of each procedure to achieve good results and avoid morbidity. A thorough knowledge of the anatomy of paediatric patients is also essential for successful nerve blocks, which cannot be substituted by probing the patient with a needle attached to a nerve stimulator. The anatomy described in adults is also not always applicable to children, as anatomical landmarks in children vary with growth. Bony landmarks are poorly developed in infants prior to weight bearing, and muscular and tendinous landmarks, commonly used in adults, tend to lack definition in young children. The aim of this research was therefore to study a sample of neonatal cadavers, as well as magnetic resonance images in order to describe the relevant anatomy associated with essential regional nerve blocks, commonly performed by anaesthesiologists in South African hospitals. This research has brought to light the differences between neonatal and adult anatomy, which is relevant since the majority of paediatric regional anaesthetic techniques were developed from studies originally conducted on adult patients. Current techniques were also analysed and where necessary new improvements, using easily identifiable and constant bony landmarks, are described for the safe and successful performance of these regional nerve blocks in paediatric patients. In conclusion a sound knowledge and understanding of anatomy is important for the success of any nerve blocks. This study showed that extrapolation of anatomical findings from adult studies and simply downscaling these findings in order to apply them to infants and children is inappropriate and could lead to failed blocks or severe complications. It would therefore be more beneficial to use the data obtained from dissection of neonatal cadavers.



Opsomming

Pediatriese Regionale Narkose: 'n Kliniese Anatomiese Studie

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In 1973 het Winnie en medewerkers bevind dat geen mediese tegniek maklik, veilig of konstant genoem kan word alvorens die anatomie noukeurig bestudeer is nie. Dit is duidelik wanneer daar na die literatuur gekyk word dat a.g.v verskeie anatomiese gebaseerde studies wat met regionale narkose in die volwassene verband hou gelei het tot die verbetering van bestaande tegnieke. Derglike studies het ook aanleiding gegee vir die ontwikkeling van nuwer, veiliger, en meer doeltreffende prosedures. Narkotiseurs wat hierdie prosedures uitvoer moet 'n voldoende kennis van die anatomie, die invloed van ouderdom en grootte voortdurend in ag neem. Hulle behoort ook deeglik bewus te wees van potensiële komplikasies en slaggate van elke prosedure. Aangesien dit nodig is om goeie resultate te verkry en sodoende morbiditeit te vermy, is 'n deeglike kennis van die anatomie van pediatriese pasiënte'n noodsaaklikheid. Vir die suksesvolle uitvoering van senuweeblokke, behoort daar 'n prosedure ontwikkel te word wat die blindelingse rondsteek van 'n naald, wat aan 'n senuweestimuleerder gekoppel is, binne in 'n pasiënt te vervang. Die anatomie wat in volwassenes beskryf word is ook nie altyd toepasbaar in kinders nie, want anatomiese landmerke variëer in groeïende kinders. Benige landmerke is swak ontwikkel in jong kinders voor die ouderdom wat hulle hul eie gewig kan dra. Spier en tendineuse landmerke, wat oor die algemeen in volwassenes gebruik word, neig ook om ongedefinieer te wees in kinders. Die doelwitte van die navorsing was dus om 'n aantal neonatale kadawers, sowel as 'n aantal magnetise resonansie skanderings te bestudeer, met die doel om die relevante anatomie wat met noodsaaklike senuweeblokke geassosieerd word en wat deur narkotiseurs in Suid-Afrikaanse hospitale uitgevoer word, te beskryf. Die navorsing het die verskille tussen die anatomie in 'n neonaat en volwassene uitgelig. Dit is relevant aangesien die meerderheid van vorige paediatriese regionale narkotiese tegnieke, uit studies wat oorspronklik op volwasse pasiënte uitgevoer was, ontwikkel is. Om die suksesvolle uitvoering van hierdie regionale senuweeblokke in paediatriese pasiënte te verbeter, moes heidige tegnieke ge-analiseer word. Waar nodig was moes nuwe verbeteringe beskryf word deur van maklike identifiseerbare en konstante benige landmerke gebruik te maak met die doel om 'n volwaardige kennis en begrip van anatomie te bekom sodat enige senuweeblok suksesvol uit gevoer kan word. Hierdie studie wys dat om bloot ekstrapolasie van anatomiese bevindinge vanaf volwasse studies slegs af te skaal om dit op jong kinders te gebruik is onvanpas en kan lei tot onsuksesvolle blokke en ernstige komplikasies. Dit sal dus meer voordelig wees om data wat vanaf die disseksie van neonatale kadawers verkry is te gebruik.



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List of Abbreviations

ISC: Distance between the two sacral cornuae

SC Height: Height of the sacrococcygeal membrane

SC Area: Surface area of the sacrococcygeal membrane

CP-XS: Distance (mm) between the coracoid process and the

xiphisternal joint

CP-LBP: Distance (mm) from the coracoid process to the LBP

CP-LBP %: Distance from the coracoid process to the LBP as a

percentage of the CP-XS line distance

CP-MBP: Distance (mm) from the coracoid process to the MBP

CP-MBP %: Distance from the coracoid process to the MBP as a

percentage of the CP-XS line distance

LBP-MBP: Distance (mm) between the LBP and MBP

LBP-MBP %: Distance between the LBP and MBP as a percentage of

the CP-XS line distance

MBP-Rib: Distance between the MBP and the closest rib

ASIS-PT: Distance (mm) between the ASIS and the PT

ASIS-N: Distance (mm) from the ASIS to the femoral nerve

ASIS-N %: Distance from the ASIS to the femoral nerve in a

percentage of the ASIS-PT distance

ASIS-A: Distance (mm) from the ASIS to the femoral artery

ASIS-A%: Distance from the ASIS to the femoral artery in a

percentage of the ASIS-PT distance

A-N: Distance (mm) between the femoral nerve and the

femoral artery

II–IH: Distance between the ilio-inguinal and iliohypogastric

nerves

CI 95%: Confidence interval with a 95% confidence level

Lower: Lower range of the Confidence interval with a level of

confidence of 95%

Upper: Upper range of the Confidence interval with a level of

confidence of 95%