Depth of insertion of a lumbar puncture needle

F Craig, J Stroobant, A Winrow, H Davies

Abstract

The depth of lumbar puncture needle insertion was recorded in 107 children. Height provided the best guide to the minimum and maximum depths of insertion. Mean depth of insertion (cm) = $0.03 \times$ height of child (cm).

(Arch Dis Child 1997;77:450)

Keywords: lumbar puncture; depth of insertion

Lumbar puncture is often left to junior members of the paediatric team, yet failed attempts prolong discomfort, increase the risk of physiological compromise from being restrained, and reduce the chance of obtaining a sample uncontaminated with blood. Prior knowledge of how far the needle should be inserted may reduce unsuccessful attempts and the number of bloody taps.

The aim of this study was to provide a practical guide that would help estimate correct depth of insertion using a child's age, height, and weight.

Subjects and methods

Lumbar puncture was performed on 107 children (age 0.01 to 16 years) as part of routine evaluation of acute and chronic illness at the Central Middlesex Hospital, Children's Hospital Lewisham, St Mary's Hospital, and Kingston General Hospital (all in the London area). Once cerebrospinal fluid (CSF) was obtained, the needle was marked at the skin before being

removed, and the depth to which the needle had been inserted was subsequently measured. We recorded the age, weight, height, and lumbar puncture needle depth of insertion for each patient. Children were only included in the analysis if CSF was not macroscopically blood-stained.

Results

Depth of needle insertion ranged from 0.5–6.5 cm and correlated best with height (fig 1). Depth of insertion and height were linearly related. Mean depth of insertion = $0.03 \text{ cm} \times$ height (cm).

Discussion

Uncontaminated CSF is essential to the diagnosis of meningitis and certain metabolic and malignant disorders. Accurate placement of the needle is also required when injecting drugs. Our results show that the depth of lumbar puncture needle insertion to obtain uncontaminated CSF correlates best with the child's height. Previous studies have produced formulas for calculating the depth of needle insertion required based on surface area,¹ or a combination of age and weight.² The disadvantage of these is that they not only require the use of a memorised formula, but also require that the child is weighed, which is often not possible in an acutely unwell child. The height or length of a sick child is much more easily measured. Once the height is known, the graph produced by this study can be used as a guide to the minimum and maximum depths between which needle insertion is likely to be successful. Alternatively, height can be multiplied by 0.03 to give mean depth of insertion. Failure to obtain CSF when the needle is inserted further than indicated suggests that it is offline. This should prompt the clinician to withdraw and try again. We hope that using the graph produced by this study might increase the chance of successful lumbar puncture and minimise trauma for the child, parents, and clinician.

Children's Hospital,
Lewisham
F Craig
J Stroobant

Kingston General
Hospital
A Winrow

Central Middlesex
Hospital, London
H Davies

Correspondence to:
Dr H Davies,
Department of Paediatrics,
Central Middlesex Hospital,
Acton Lane,
London NW10 7NS.

Accepted 31 July 1997

Figure 1 Depth of successful lumbar puncture needle insertion relative to height.

1 Bonadio W, Smith D, Metrou M, Dewitz B. Estimating lumbar-puncture depth in children. *N Engl J Med* 1988;319:952-3.

2 Hasan M, Howard R, Lloyd-Thomas A. Depth of epidural space in children. *Anaesthesia* 1994;49:1085-7.