PLASTINATION OF THE NEUROANATOMICAL SPECIMENS: DOES FREEZING PRIOR TO DISSECTION GIVE BETTER DISTINCTION BETWEEN NUCLEI & FIBRE TRACTS?

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ABSTRACT

With the recent decline in the number of brains available for dissection, the use of pre-dissected, plastinated specimens has become increasingly important in the teaching of neuroanatomy. For the specimens to be of the most value, however, it must be possible to distinguish nuclei from fibre tracts. Since freezing of brain tissue prior to dissection generally increases the distinction between gray and white matter in unplastinated specimens,~the following study was carried out to see if the freezing method resulted in better differentiation between nuclei and fibre tracts in plastinated specimens.

Brains previously fixed in 10% formaldehyde were washed overnight in cold, running water, then placed in a plastic bucket containing fresh 10% formaldehyde, and stored in a deep freeze, at -25YC, for 8 days. The brains were then thawed under cold, running water, for 24 hours. The freezing and thawing procedure was repeated twice more before dissection was performed. These dissected specimens, along with those of fixed brains that had not been previously frozen, were then plastinated together, using the standard S-10 method.

It was found that freezing the brains made the dissection of both nuclei and fibre tracts easier. However, the cortex of the "frozen" brains was more fragile and , therefore, more prone to damage during dissection. Nuclei and fibre tracts were equally distinctive in both "frozen" and "unfrozen" brains, suggesting that, for the purposes of plastination, freezing the brains does not enhance the distinction between nuclei and fibre tracts.

INTRODUCTION

The number of donated brains available for the teaching of neuroanatomy has decreased significantly in recent years. Consequently, it has become increasingly important to produce dissected specimens, that are long-lasting and durable. This goal can be achieved by plastination. To be of optimal value, however, the specimens must be of the highest quality. In dissected specimens, this means that there should be good definition of gray and white matter, particularly fibre tracts running through the white matter. In this respect, it has been found that the distinction between gray and white matter in "wet" specimens can be enhanced by freezing the brain prior to dissection (Gluhbegovic & Williams, 1980). The present study was carried out to see if the freezing method produced similar, advantageous results in plastinated specimens.

METHODS

Control Specimens

Brains which had been well fixed in 10% formalin were washed in cold, running water for 24 hours, then dissected, using straight or curved fine forceps and micro-dissecting knives, to show features such as subcortical fibre tracts and basal ganglia.

Experimental Specimens

The methods used in preparing the experimental specimens were adapted from Gluhbegovic & Williams (1980). Following washing in cold running water, as above, fixed brains were:

1. Placed in a plastic bucket containing 10% formalin and stored in a deep freeze at -25YC for 8 days.
2. Thawed under running cold water for 24 hours.

Steps 1 & 2 were repeated three more times before dissections, similar to those performed in control specimens, were carried out.

Control and experimental specimens were plastinated together, using the standard S-10 method described by von Hagens (1986).

RESULTS AND DISCUSSION

Freezing and thawing was found to facilitate dissection in the experimental specimens, and distinction between grey and white matter was just as good in control specimens as in experimental specimens. Two specimens from the experimental group are shown in Figure 1A and Figure IB. Features that can be identified include the caudate nucleus, internal capsule and parts of the pyramidal system. Two specimens from the control group are shown in Figure 1C and Figure ID. They also show features of the caudate nucleus, internal capsule and parts of the pyramidal system. The fibre tracts running through the white matter are equally visible in control and experimental specimens. The distinction between grey and white matter is also similar in the two groups. Note that the cerebral cortex in some areas of the experimental brains is damaged. This may well be due to the rapid temperature change during the specimen preparation. The composition of the grey matter (cell bodies) and white matter (myelinated axons) are quite different. Protein is an essential part of the cell body while the myelinated axons are enclosed in the myelin sheath of which lipid is the main component. The temperature change resulting from freezing and thawing may cause the breakdown of the protein, with little or no effect on lipids, resulting in damage to cortical areas (grey matter), during the handling of the experimental specimens, as shown in Figure IB.

The results of this study suggest that the extra time and effort involved in freezing and thawing specimens prior to dissection is not warranted, since the same quality of fibre and

grey/white matter distinction can be achieved using brain specimens which have been fixed and washed at room temperature.

REFERENCE

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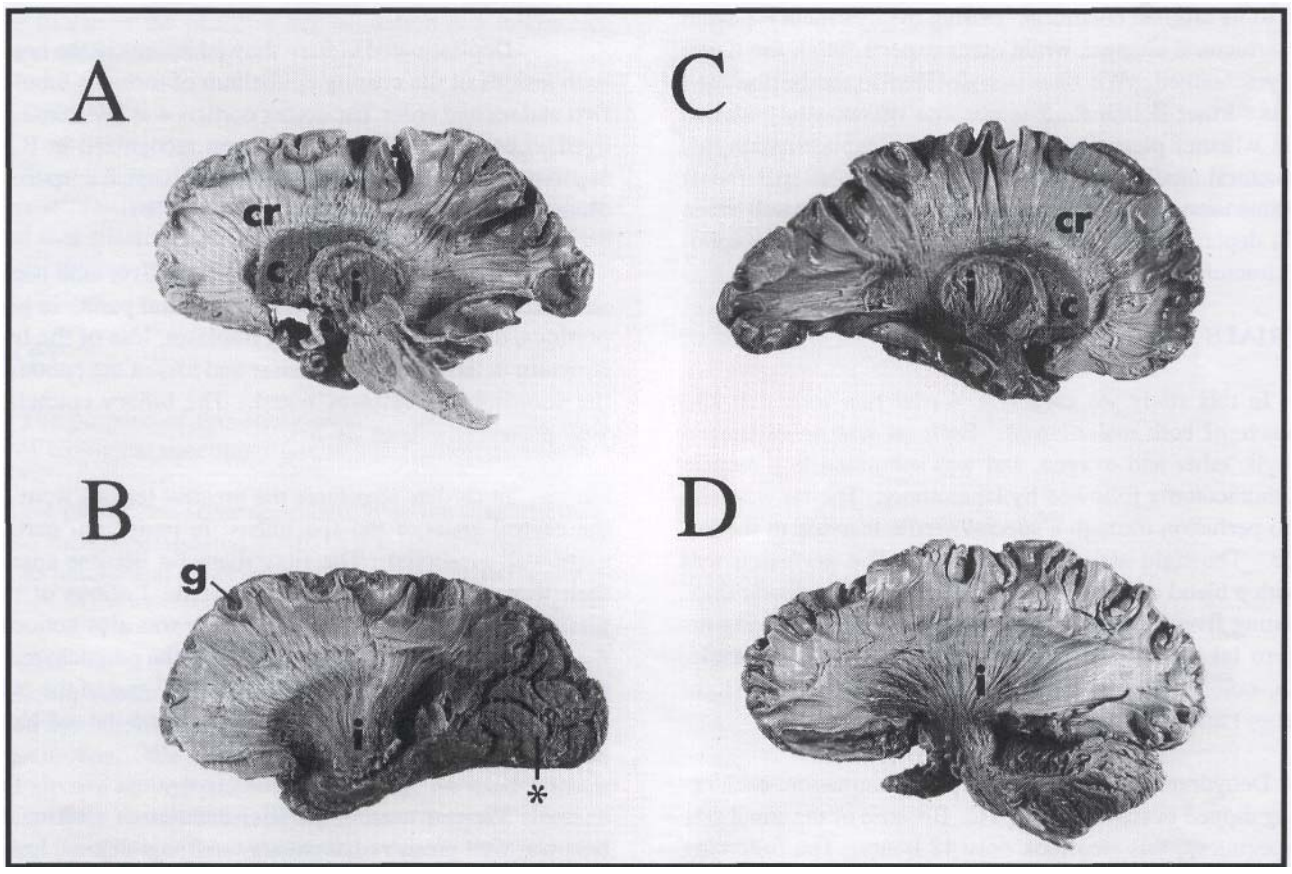

Fig.l

Examples of dissected specimens from the experimental (frozen) group (A and B) and control group (C and D). Features that can be identified include the caudate nucleus, internal capsule and pyramidal system. The fibre tracts running through the white matter are equally visible in control and experimental specimens. The distinction between grey and white matter is also similar in the two groups. Damaged cerebral cortex in one of the experimental brains is marked with an asterisk. Abbreviations: c: caudate nucleus; cr: corona radiata; g: cortical grey matter; i: internal capsule.