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Vacuum-based preservation of surgical specimens: An environmentally-safe step towards a formalin-free hospital

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ABSTRACT

Formalin as a fixative has no practical substitutes, but is toxic and potentially carcinogenic, so caution of its use in hospitals and elsewhere is mandatory. In our hospital, preservation of surgical specimens into formalin to be transferred to pathology labs was replaced by under-vacuum sealing (UVS) tissues into plastic bags and preservation at 4 °C until transfer. Data analysis showed UVS processing to be superior in terms of staff satisfaction and of gross anatomic preservation; no problems in terms of technical feasibility or histopathologic preservation were encountered. Formalin was confined to pathology labs while its use on hospital premises was vastly reduced.

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1. Introduction

Formalin, a 4% solution of formaldehyde in water, is a world-wide and extensively used fixative for histopathological specimens. Since its discovery at the end of 19th Century (Fox et al., 1985), this aldehyde has been universally appreciated as a simple reagent that is a good antiseptic, penetrates tissues quickly (diffusion rate of 1 cm in 24 h) and is easy to handle. In tissues that are formalin-fixed, morphology is well preserved, as is tissue antigenicity, and immunohistochemical procedures of diagnostic interest have routinely been adapted to formalin-fixed tissues (Dabbs, 2008).

In addition to multiple industrial applications, the medical use of formalin as a tissue preserver and fixative is extensive, especially in pathology laboratories. In fact, the amount used in public hospitals in the Piedmont region (Italy) alone for the preparation of approximately 300,000 histological exams is in the range of 100,000 liters per year.

Tissues preserved in formalin are even sent by post, in the number of several thousands per year.

Despite its advantages, formaldehyde has some drawbacks that demand caution: it is allergenic to the skin and produces irritating vapors, causing asthma. The International Agency for Cancer Research

(IARC, 2006) has declared formaldehyde to be a Class 1 carcinogenic agent, and statistical evidence has been presented on a possible link between formaldehyde exposure and lymphohematopoietic malignancies (Beane Freeman et al., 2009).

Several attempts have been made to find a substitute for formalin, but so far all of the proposed alternatives have failed, being either ineffective or unreliable (Titford and Horenstein, 2005). A more practical approach would be to limit the use of formalin to pathology laboratories, where this toxic agent is carefully handled with hoods and gloves in safe environmental conditions, and to avoid its use in other less-protected areas of the hospital, such as in surgical theaters, where removed tissues are commonly placed in boxes full of formalin until transfer to the pathology labs. In fact, despite the advantages linked to this procedure (fixation and anti-sepsis begin immediately for the removed tissues and organs, and dehydration is avoided) several disadvantages are also recognized (see Table 1).

To overcome these problems, we proposed an alternative procedure, which is the under-vacuum sealing of tissues (UVS) in plastic bags inside the surgical theatre immediately after removal, and to keep them cooled at 4 °C until transfer to the pathology labs, where they are routinely processed.

Safety and advantages linked to this UVS procedure have already been reported elsewhere (Bussolati et al., 2008). This processing was tested for more than two years in a single surgical theater, and it is now being extended to the whole hospital.

The present study compares the compliance of personnel and the feasibility of this new procedure in a large regional hospital to the

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