Journal of the International Society for Plastination 18:34-36 (2003)

Dry Preservation of Cadaveric Hearts: An Innovative Trial

S. MEHRA*, R. CHOUDHARY and A. TULI

Department of Anatomy, Lady Hardinge Medical College, New Delhi, India.

**Correspondence to: Telephone:* 011-5595616; *Fax:* 011-6848007; *E-mail:* ambuja42@rediffmail.com

Abstract: Decay is a vital process in nature but an impediment to morphological studies, teaching and research. It has always been a goal for anatomists to find suitable preservation techniques. Wet cadaveric specimens allow 'hands on' learning but students and teachers have to contend with noxious formalin fumes. This paper describes an alternative approach to the study and teaching of gross anatomy of human hearts to undergraduate and postgraduate students using Quickfix® impregnated dry cadaveric hearts. Formalin fixed hearts were utilized as the source of specimens to be plastinated. The reasons for this choice were a result of the decreased cadaveric availability and limited funds in our institution. The procedure is simple to perform, cost effective and carried out at room temperature (37°C-40°C). It precludes the use of expensive resins and equipment. The hearts were well preserved in the dry state without showing any change of color or fungal growth. We regard this process as an important factor in bridging the gap between anatomy and clinical practice.

Key words: **anatomy; cadaveric hearts; dry preservation; education; low cost**

Introduction

Reduction in clock hour allotments to the study of anatomy in the MBBS curriculum in our country necessitates an increased emphasis on teaching with the help of preserved, prosected specimens. Formalin fixed anatomical specimens are traditionally displayed in glass jars immersed in 10% formaldehyde. These are questionable teaching tools as the formaldehyde jars are fragile and immersion in fluid makes viewing difficult. They may be removed for observation but handling is unpleasant because of formaldehyde fumes. Also, on exposure to air, such specimens quickly lose color and their surface features progressively deteriorate. Dry preservation of cadaveric specimens is an alternative to formalin preservation. Plastination, a widely recognized technique for preserving biological tissue, was invented by von Hagens (1979). This procedure produces dry, odorless, durable and manipulative specimens. A number of innovations of von Hagens techniques have been tried by several investigators (Bickley et al., 1981; Tiedeman and von Hagens, 1986; Romero-Sierra et al., 1986; Updike and Holladay, 1986). All these require use of expensive resins and equipment. Keeping in view our limited financial resources and the high import cost of chemicals, the present study describes the use of locally available adhesives and chemicals for dry preservation of formalin fixed anatomical specimens with particular reference to human hearts. The technique (Janakiram et al., 1993) used in the present study has so far not been tried on whole visceral organs like heart. Such specimens complement existing teaching initiatives in a variety of disciplines from general biology courses through specialized courses in pathology, forensic medicine, oncology and are of great benefit to research.

Materials and methods

Twelve formalin fixed adult human cadaveric hearts were washed under running tap water to clean and remove blood clots. Excess water was squeezed out and the surface of the heart was wiped dry with a sponge. **In**

six hearts, the mitral and tricuspid valves were displayed using classic dissection procedures. Specimens were then immersed in an undiluted solution of commercial grade acetone for one week to remove tissue water. They were then removed from the acetone and suspended from hooks to be dried for 24 hours in a well ventilated room. A solution comprising equal parts of Quickfix® (Wembley Laboratories) and amylacetate was then prepared in glass jars large enough to hold two specimens. Specimens were immersed in this solution for a period of three months. The glass jars were sealed airtight. The specimens were taken out and suspended to be dried for 24 hours. The surfaces of the specimens were then coated with a fresh solution of Quickfix® (50% by volume) in amyl acetate with a fine brush and allowed to dry before being kept in the departmental museum for display. This procedure was repeated using varying dilutions of Quickfix® (60% v/v and 40% v/v) in amyl acetate against a fixed volume of amyl acetate. These techniques were carried out at room temperature (37°C to 40°C).

Results

The finished specimens were best in the trial utilizing equal amounts of Quickfix® and amyl acetate. The hearts were dry, hard to the touch and dark in color with a fine polished appearance (Fig. 1). The atrioventricular valves were translucent with clarity of detail (Fig. 2). There was good contrast between structures. The chordae tendinae were flexible. The rough and clear zones of the valve cusps were distinctly visualized against natural light. Even after three years, we have not found any deterioration of the specimens nor any color changes. Additionally, we have noted no fungal growth on the specimens.

Discussion

As more and more emphasis is placed on the use of prosected specimens to support teaching and learning of gross anatomy, and with the limited supply of finances and cadavers in our institution, we have tried to preserve cadaveric hearts using, non expensive and locally available chemicals like Quickfix®, amyl acetate and acetone. Prolonged exposure to Quickfix® and amyl acetate solution achieves adequate tissue penetration of the adhesive without the need of vacuum embedding as with von Hagens' plastination technique. Quickfix® alone is highly viscous and requires an equal amount of solvent to attain the desired viscosity to penetrate the deeper areas of the hearts. The proportion of equal volumes of Quickfix® and amyl acetate was found to be ideal in this study as is also reported by Janakiram et al. (1993) in their plastinated hand specimens. A certain degree of shrinkage was observed in the finished specimen. This, however, does not alter the gross relationships of the various structures within the specimen. Trials involving higher dilutions with solvents caused inadequate penetration of the specimens with marked shrinkage and rigidity.

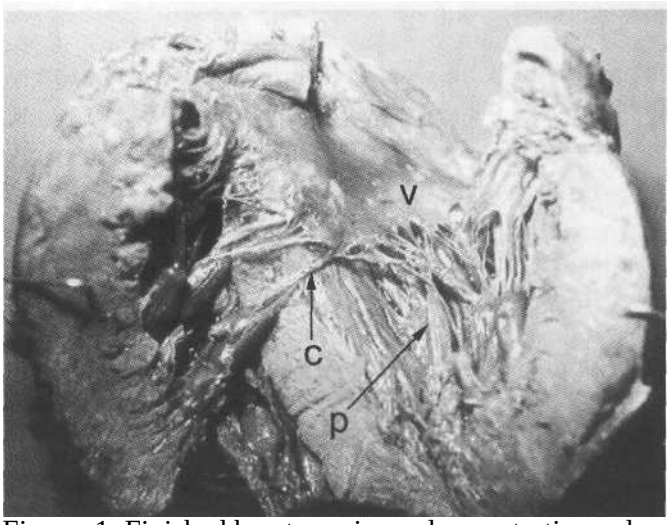

Figure 1. Finished heart specimen demonstrating valve leaflet (v), chorda tendineae (c) and papillary muscle (p).

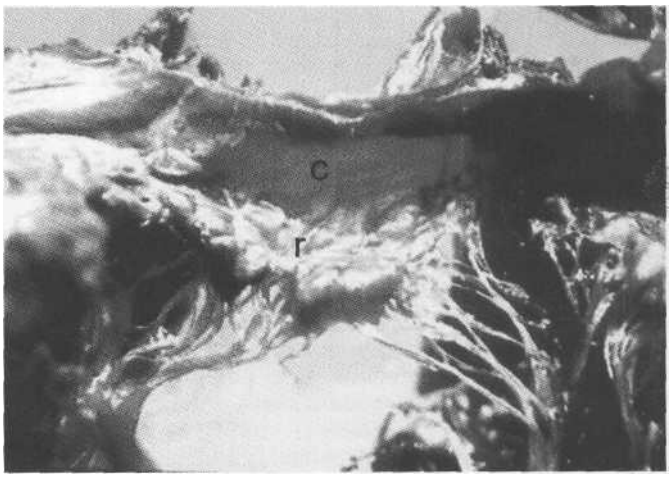

Figure 2. View of valve leaflet demonstrating the clear (c) and rough (r) zones.

Specimens preserved by this method are much lighter than their wet counterparts. They are non-toxic and durable despite the day to day handling. This technique has been reported (Janakiram et al., 1986) to preserve thin slices (100 microns) of gross specimens like lung, liver and heart in a dry state. Quickfix® has been used as a mounting medium in histology studies (Victor et al., 1988). To date, the technique described here has not been reported to be used for preserving whole visceral organs like the heart. The technique of heart plastination described by Tiedemann and von Hagens (1982) involves the use of special equipment

and expensive resins. In contrast, the technique followed by us is cost effective, simple to perform, precludes the use of costly equipment and stringent temperature requirements. These new and unique teaching aids preserve the anatomical details observed during dissection. Such specimens are of obvious use in teaching anatomy courses that comprise a multimedia approach utilizing wet specimens, plastic or plaster of pans models, radiographs, diagrams and computers.

Literature cited

Bickley HC, von Hagens G, Townsend FM. 1981: An improved method for the preservation of teaching specimens. Arch Pathol Lab Med 105:674-676.

Janakiram S, Balasubramanyam V, Victor R, Thomas IM. 1993: Dry preservation of cadaveric material: An indigenous trial. J A S 142(2):95-97.

Janakiram S, Victor R, Kamath S, 1986: Plastic mounted sections for teaching and museum display. J ASI36(1):71.

Romero - Sierra C, Webb JC, Lyons GW, Desmarteau JK, Carlson KC. 1986: Preparation of freeze dried hearts for use as teaching aids. Collection Forum 2(2):11-13.

Tiedemann K and von Hagens G. 1982: The technique of Heart plastination. Anat Rec 204:295-299. Updike SJ and Holladay SD. 1986: Preparation of flexible models of hollow gastrointestinal organs. Anat Rec 216:207-210. Victor R, Janakiram S, Chinamma KC, Kamath S. 1988: Plastic mounting of histological sections for teaching and display. Clinician 52(6): 162-164. von Hagens G. 1979: Impregnation of soft biological specimens with thermosetting resins and elastomers. Anat Rec 194:247-256.