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Short Communication

Use of formalin and modified gravity-feed embalming technique in veterinary anatomy dissection and practicals

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Gravity feed embalming technique was used to preserve cadavers for teaching of gross anatomy and practicals. Six white Fulani cattle were used. The gravity feed technique was employed to embalm through the right common carotid artery. The right external jugular vein was used to drain blood from the vascular system concurrently. Complete embalming was achieved in about 10 h using an embalming fluid constituted of a combination of 10% formalin, phenol and glycerine. The technique demonstrated cost efficiency and reliability as there was minimal tissue and organ distortion.

Key words: Gravity-feed technique, embalming, formalin, veterinary anatomy dissection.

INTRODUCTION

Embalming is the art and science of preserving the body of an animal after death with the use of certain chemicals. This is done to forestall decomposition for long term preservation. The procedure has been practised in many cultures and is one of the earliest surgical procedures humanity ever undertook (Frederick and Strub, 1989). In some parts of the world, elements of the climate, such as extreme cold or dry heat, act as natural preservatives, creating corpses that do not decompose and maintain their form for great lengths of time.

Embalming has a very long and cross-cultural history, with many cultures giving the embalming processes great religious meanings (Ezugworie et al., 2009). The earliest chronicle of embalming is that which occurred in Egypt over 5,000 years ago. It was a religious practice which imbibed the belief of resurrection through the preservation of bodies (Mayor, 2000). The second main epoch of embalming history is the period of the Renaissance in Europe, a period in which embalming techniques were primarily used to preserve the dead for purposes of dissection and study (Saeed et al., 2001). The third distinct period is the modern history, from 1861, the start of the American Civil War, to the present day. During the Civil War, embalming became more common, initially required by public transportation services for the purpose of effective delivery of corpses to their final resting places from the battlefields (Saeed et al., 2001). It became an invaluable means of maintaining corpses of prominent military officials, whose bodies might travel to a number of locations for memorial outfits. In these distinct periods, the methods of embalming varied considerably. However, it is interesting to note that modern embalming techniques are the result of accumulation of knowledge over decades, from researches, errors and inventions (Saeed et al., 2001; Ezugworie et al., 2009). The gravity feed embalming technique involves the use of gravity to perfuse a cadaver. In this technique, a container dispensing the embalming fluid is elevated above the body's level. The fluid is slowly introduced over an extended period of time, often for several days. No drainage occurs and there is no separate cavity treatment of the internal organs (Ezugworie et al., 2009). This article describes a

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modification of this technique.

In more recent times, techniques of embalming have become a matter of necessity. The study of anatomy and the technique of dissection, for example, have necessitated some methods or materials that would allow carcasses to be studied for longer periods in warm as well as cold weather. The modern practice of embalming utilizes the so-called 'arterial embalming' technique (Ezugworie et al., 2009). This involves injecting an embalming fluid into the arterial system of a cadaver and utilizing the whole vascular system. Ideally, this method involves the use of a centrifugal embalming pump which is not readily available in Nigeria. This article outlines a modification of the gravity feed method of embalming that has proved efficient. It also discusses the prospects and consequences of the use of formalin as an embalming fluid in a bid to suggest safer and more efficient alternatives.

METHODOLOGY

The procedure was carried out in the Department of Veterinary Anatomy, Faculty of Veterinary Medicine, University of Abuja (8° 56' 29" North, 7° 5' 30" East). Six young white Fulani cattle were obtained from Lambata cattle market of Niger state, Nigeria. They had approximate weights of 60 to 80 kg. The animals were kept without food but with sufficient water for about 18 h prior to the start of the procedure. This was done to reduce the gastrointestinal microbial activity.

Ten percent formalinwas constituted and put into a 60 L calibrated tank which possessed a control tap at its base. The tank was then mounted at a height of about 4 m and precautions taken to avoid air bubbles in the fluid so as to prevent air locks. Other constituents of the tank included: 0.5 L phenol to prevent fungal growth and 1.0 L glycerine to reduce excessive adhesion hence making the tissues easier to separate during dissection. A long rubber tube of about 4.5 m was connected to the control tap at the base of the tank and a 19 G needle was attached to the free end.

The procedure was carried out on one animal at a time. Each animal was anaesthetized with about 22 mg per kg of thiopental sodium (2.5%) (Trittau, Germany) IV and casted on left lateral recumbency. A shallow 10 cm longitudinal incision was made a little below the ramus of the mandible along the jugular furrow, and the right external jugular vein and right common carotid artery were exposed by blunt dissection. The common carotid artery was properly exposed from the carotid sheath and separated from the recurrent laryngeal nerve. The 19 G needle at the free end of the rubber tube was then inserted into it. The control tap was turned on and another needle (21 G) inserted concurrently into the external jugular vein to ensure drainage of blood. A smaller sized needle was used to reduce the rate of drainage relative to the rate of in-flow of the embalming fluid. The needle point of insertion was ligated when complete blood drainage was noticed. To the needle inserted into the common carotid artery, two ligatures were put in place to secure its position.

As the embalming fluid was gradually pumped into the animal by gravity-feed, cotton wool was used to occlude all the external orifices to reduce sippage. The cadaver was massaged throughout the process to ensure proper distribution of embalming fluid. Adequate circulation of the embalming fluid was confirmed when foaming fluid was noticed to be sipping out through the skin and all the external orifices. After this period of embalming, the animals were left to lie on the bench for about 48 h before evisceration of the lower parts of the gastrointestinal tract. The eviscerated parts were immersed into large drums containing 10% formalin at an immersion ratio of 1 part of tissue to 9 parts of formalin.

RESULTS AND DISCUSSION

Veterinary Anatomy is a basic subject in the study of Veterinary Medicine and related biomedical sciences (Korf et al., 2008). Animal dissection is an integral part in the learning of Veterinary Anatomy (Johnson, 2002). It is a central tool used for teaching anatomy in university veterinary medical schools as the students learn the basic constructional principles of the animal body by dissecting the cadaver. In recent times, the value of dissection has been a challenging subject of discussion in developing countries due to high costs and problems of shortness in time in some veterinary medical curricula. With the advent of new techniques and computers, alternative methods of teaching anatomy have come into existence. However, the gross anatomy dissection offers the unique possibility of learning through practical development of manual skills required for adequate comprehension of the subject matter.

In this demonstration, complete embalming took approximately 10 h per animal and completely embalmed cadavers were used for anatomy dissection which spanned through a period of approximately 10 months. This proved more efficient than the technique involving the use of gluteraldehyde which has been documented to be suitable for cadaver preservation for up to 6 weeks (Tolhurst and Hart, 1990). Though the composition of embalming fluid has been under continuous review for many years, the constituents used for this procedure were tailored towards proper tissue fixing, fungicidal and bactericidal activities. However, improved embalming fluid composition for anatomy dissection have been suggested (O'Sullivan and Mitchell, 1993) as concerns have recently been expressed about formaldehyde levels in dissecting rooms and embalming suites in anatomy departments.

The highly poisonous chemical, formalin, with attractive characteristics has long been debated in the field of embalming, with many choosing to expose themselves to an unknown degree of risk (Heimlich, 2008). The primary criticism of formalin fluid is associated with the inhalation of formaldehyde fumes which commonly causes mucosal irritation of the upper respiratory tract (Riedel, 1996), or formaldehyde absorption through the skin, which is known to cause skin irritation, eczema and in extreme cases can lead to allergic dermatitis or hives (Owen and Beck, 2001; Heimlich, 2008). With the eyes, exposure to formaldehyde vapour can cause reddening and burning sensations, accompanied by tears production (Bedino, 2004). Furthermore, prolonged exposure is suspected to be associated with cancers of the lung, nasopharynx, oropharynx and nasal passages (Hansen, 1996; Viegas et al., 2010). However, it is assumed that very good

ventilation, use of protective clothing such as laboratory coats, gloves and masks could reduce these known risks to a reasonable level.

Embalming by arterial injection is the most practised form of embalming for veterinary anatomical studies. It is fast and involves the use of a centrifugal embalming pump (Ajao et al., 2010). However, in developing countries like Nigeria where the required equipment is not readily available, an improvised modified gravity feed technique of embalming has proved efficient. This technique offers the advantage of ease of assembling of the apparatus to anatomists with limited resources. It is also much faster than the typical gravity feed system where drainage of blood and intestinal fluids is not done.

Conclusion

The modified gravity feed method of embalming has proved effective. The cadavers remained suitable for anatomy dissection practicals which spanned through a period of 10 months and even more. However, it is proposed that the results can be improved if the embalming fluid constituents are reconsidered as the commonly used concentration and quantity may not be suitable for some working environments.

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