TECHNICAL NOTE

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Shadow Positioning Technique: A Method for Postmortem Identification

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ABSTRACT: Radiology is increasingly being used as a means of postmortem identification. We have devised a shadow positioning technique by which a postmortem radiograph of a skeletal part can exactly duplicate an antemortem radiograph, thus, faciliating identification by comparison of the antemortem and postmortem radiographs. The antemortem radiograph can be of any skeletal part and taken in any position.

KEYWORDS: forensic science, X-ray analyses, human identification

Human remains are usually identified visually, through fingerprints, or dental means. Comparison of antemortem and postmortem radiographs is an accurate, but underutilized, method of identification. We describe a technique in which the postmortem radiograph can duplicate the antemortem film. Identification is then easily accomplished.

Since Culbert and Law's [*1*] first report, there have been few other references in the literature [*2-4*]. Radiology was first used in a mass disaster by Singleton's identification of victims when the Great Lakes Liner, the Noronic [*5*], sank.

Methods

This technique involves using a film duplicator with the ability to alter the density of the film, such as a L.A.B. 500 duplicator/subtractor. Using this duplicator, a duplicate antemortem radiograph is produced. This radiograph is lightened such that all detail is removed. Only the outline of the skeletal part remains. This copy film is referred to as a "film mask."

The "film mask" is placed on a cassette of the same size as the original antemortem radiograph. The tube head is positioned at the film focal distance that corresponds to the antemortem exam. Generally, 1016 mm (40 in.) is the tube film distance. Exceptions to this are the Towne's view, which is 914 mm (36 in.), and the PA chest, which is 1829 mm (72 in.). An AP

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chest distance is 1016 mm (40 in.). The tube is aligned such that the central ray passes through the center of the film and the field is coned down. The skeletal part to be duplicated is held between the tube head and the film with the positioning light on. The bone is manipulated until its shadow superimposes on the outline of the skeletal part of the film mask. The bone to be radiographed ideally should have all soft tissues removed from the skeletal part. Even a small amount of soft tissue may interfer with radiographic quality. Residual soft tissue may produce shadows that make superimposition difficult and interfere with duplicating magnification. If all soft tissues are moved, the antemortem soft tissue magnification is duplicated by manipulating the skeletal part such that the shadow of the bone is exactly superimposed on the outline of the skeletal mask. When exact superimposition is accomplished, a radiograph is taken. Using par speed screens and cassettes (200 film speed system), we have found that 2 mA at 55 kV is a suitable technique for most parts. The film is processed and ready for comparison with the original radiograph (Figs. 1 and 2).

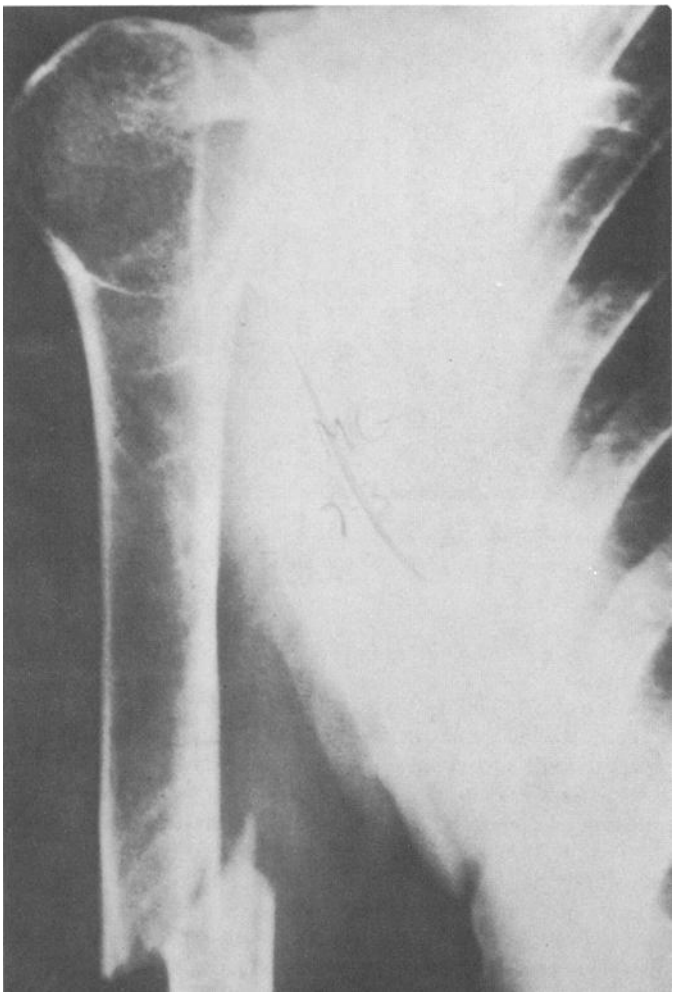

FIG. 1—*Antemortem radiograph.*

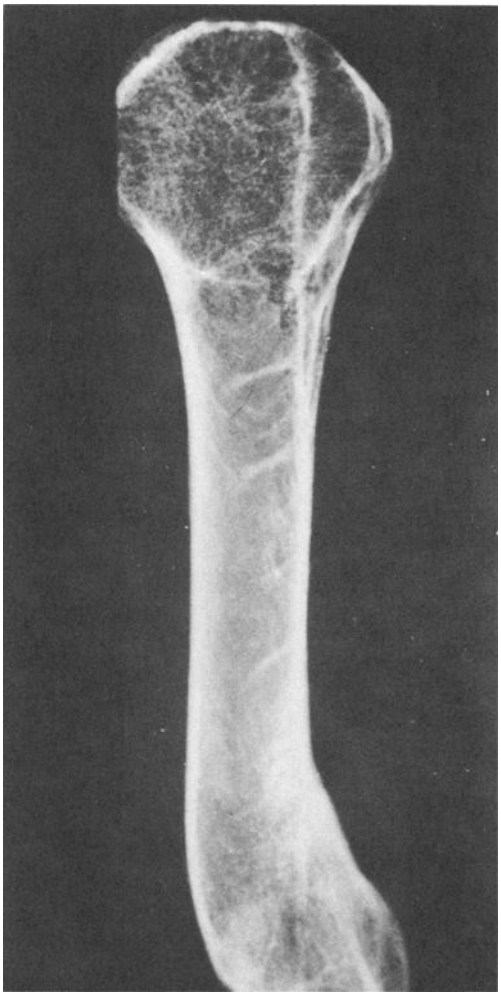

FIG. 2—*Disarticulated right humerus. Note the similar Harris lines from the proximal humeral shaft. Note also the general shape of the humeral head and the similarity of the trabecular pattern superiorly.*

Discussion

We have identified over 100 individuals radiographically, but this technique has been used in a minority of cases. Usually, a postmortem radiograph suitable for use in identification can be obtained by appropriate angulation and positioning of the X-ray beam to the skeletal part. However, in some cases, this is not satisfactory and the shadow positioning technique must be used because the general shape of a bone and its part such as trabeculae, pedicles, spines, vascular grooves, and so forth change depending on their relationship to the X-ray beam. Although two radiographs may be of the same part, beam centering, angulation, and bone rotation may so alter the radiographic image that the bones may appear dissimilar. The X-ray beam originates from a 1-mm source but then disperses such that X-rays enter body parts at increasingly obtuse angles towards the periphery of the beam. Thus, the orientation of landmarks change depending on the angle that the X-ray beam enters the part.

Many of the identifications we made were upon fragmented skeletons or skeletal parts, burn

victims with distorted skeletons, and decomposed bodies. Radiographic identification is an exact means of identification, and has been accepted in testimony in both civil and criminal proceedings.

The shadowing position technique enables the radiographer to duplicate the position and magnification of the antemortem radiograph. This method works best with long bones but has been successfully accomplished with most skeletal parts. We have not attempted it with the clavicle, which is probably the hardest bone to duplicate.

Radiographic identification depends on the availability of antemortem radiographs. At the Cook County Medical Examiner's Office, it is replacing dental identification because medical X-rays are usually easier to locate than dental records. Friends, relatives, and even casual acquaintances are likely to be aware of a prior hospitalization of a deceased person, but few will know his or her dentist.

Acknowledgments

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