

PAPER**PATHOLOGY/BIOLOGY**

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An Assessment of the Usefulness of Routine Histological Examination in Hanging Deaths

ABSTRACT: A retrospective study was carried out on 100 randomly selected medico-legal autopsies of victims who had committed suicide by hanging. All cases had undergone full police and coronial investigation. Complete external and internal examinations had been carried out including routine histological examination of organs. The age range of victims was 15–94 years (average, 41.7 years) with a male-to-female ratio of 7:1. External and internal injuries were consistent with the reported events. Diagnoses based purely on histology included hepatic steatosis ($n = 16$), asthma ($n = 3$), lymphocytic thyroiditis ($n = 2$), and pulmonary and cardiac sarcoidosis ($n = 1$). A large cell carcinoma of the lung and a rectal adenocarcinoma were confirmed. Histological evaluation was, however, of limited usefulness in contributing to the medico-legal evaluation of cases, with careful scene, external and internal examinations providing the most relevant information. The results of histological examination of tissues were all incidental to the cause, mechanism, and manner of death.

KEYWORDS: forensic science, suicide, hanging, autopsy, microscopy, histology, audit

Suicide refers to a deliberate act of self-destruction with the most commonly occurring method in Australia being hanging (54%) (1). In South Australia, all hanging suicides are reported to the State Coroner with autopsy examinations being conducted in the majority of cases (>99%). While all cases of suspected hanging referred for autopsy undergo a complete examination, including external, internal, and microscopic assessments, the usefulness of routine histology has been debated (2–5). The following study was undertaken to evaluate the contribution of histological evaluation of tissues and organs to the determination of the cause, mechanism, and manner of death.

Materials and Methods

A retrospective study was conducted of 100 randomly selected cases of suicide owing to hanging that had been referred to Forensic Science SA, Adelaide, Australia, for autopsy by the South Australian State Coroner. Cases where delayed death had occurred in hospital from multi-organ failure or hypoxic–ischemic encephalopathy following hanging were excluded owing to the confounding effect of superimposed pathological changes. All cases had undergone full coronial investigations with death scene examinations and witness/family interviews conducted by attending police. Complete external and internal examinations had been carried out by forensic pathologists including photographic documentation of injuries. Routine histological examination of organs included sections from the heart, lungs, liver, kidneys, and brain. In addition, pathologists took samples of significant macroscopic findings for histological assessment. All case files were reviewed, and circumstances of the hanging, age, gender and autopsy findings were recorded. Toxicological results were not subject to investigation in this study.

Results

All deaths were because of neck compression from hanging with the manner of death being suicide. The age range of victims was 15–94 years (average, 41.7 years) with a male-to-female ratio of 7:1. In four cases (4%), advanced decomposition was present which limited information obtained during autopsy.

External Examination

External examination confirmed the presence of a ligature mark in all cases. An obvious parchmented ligature mark around the neck leading up to a suspension point was present in 91 cases (91%), and a faint mark or indentation was noted in the remaining nine cases (9%). Twenty-three cases (23%) had conjunctival petechiae, and three cases (3%) had marked facial congestion/petechiae, features compatible with low suspension hanging. Twenty-four cases (24%) had tongue protrusion with desiccation. Minor recent injuries were found in 43 cases (43%). These consisted of small abrasions, contusions, and lacerations that did not have the pattern of an assault and which were considered owing to either agonal movement of the victim or postmortem damage when the body had been cut down or moved at the scene. Scarring of the wrists or forearms in keeping with previous suicide or parasuicide attempts was found in five cases (5%). The features found on external examination corroborated the history and scene findings in all cases (Table 1).

Internal Examination

Neck dissection revealed fractures of both the hyoid bone and thyroid cartilage in 10 cases; fractures of the hyoid bone alone were present in nine cases, and thyroid cartilage fractures alone were seen in 22 cases. The 19 hyoid fractures were left-sided in 12 cases, right-sided in four cases, and bilateral in three cases. The 32 thyroid cartilage fractures were bilateral in 17 cases, involved the

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TABLE 1—Stages during the autopsy where findings supported the diagnosis of the cause, mechanism, and manner of death in 100 hanging deaths.

Stage of Autopsy	Number of Cases (%) Contributing to the Diagnosis
External examination	100 (100)
Internal examination	
Neck	43 (43)
Elsewhere	0 (0)
Histology	0 (0)

right superior horn in 11 cases and the left superior horn in four cases. Soft tissue hemorrhage adjacent to fractures was noted in only nine cases, with bruising in other soft tissues of the neck present in six cases (two of whom had no associated fracture). There were no cervical vertebral fractures. Thus, fractures of the hyoid–laryngeal complex and/or hemorrhage in keeping with neck compression from hanging were seen in 43% of cases.

Further internal examination involved the body cavities with inspection of the chest organs revealing anthracosis and emphysematous bullae in 19 cases. Four cases had aspiration of gastric contents into the airways, and resuscitation-related rib fractures were present in three cases. Cardiovascular examination identified significant atherosclerosis of the coronary arteries and/or aorta in 48 cases, usually associated with age. However, a 20-year-old man without any history of cardiovascular disease was found to have with marked focal coronary atherosclerosis. Nine cases had myocardial scarring, and five had valvular pathology. A previously diagnosed lung carcinoma was confirmed in a 44-year-old man.

Examination of abdominal organs revealed enlarged fatty livers in four cases and a previously unsuspected rectal carcinoma in a 77-year-old man. Other incidental gastrointestinal findings included colonic diverticulae and previous appendectomies. Common findings in the genitourinary system included scarring or cystic disease of the kidneys, prostatomegaly, and uterine fibroids. A solitary endometrial polyp was also documented. Craniofacial, spine, and limb examinations did not reveal any significant occult injuries, fractures, or diseases.

Histology

Microscopic examination of tissues was in keeping with the above macroscopic observations; 35 cases had no microscopic findings of note. The tumor of the lung was confirmed as a large cell carcinoma and the rectal tumor an adenocarcinoma. The endometrial polyp was benign. Diseases/lesions that were only identified on microscopy included hepatic steatosis ($n = 16$), chronic prostatitis ($n = 4$), asthma ($n = 3$), lymphocytic thyroiditis ($n = 2$), bronchiolitis ($n = 1$), pulmonary and cardiac sarcoidosis ($n = 1$), hepatitis ($n = 1$), von Myenberg complexes ($n = 1$), a liver adenoma ($n = 1$), a liver cavernous hemangioma ($n = 1$), a renal fibroma ($n = 1$), chronic cystitis ($n = 1$), and lacunar infarcts of the brain ($n = 1$). No histological finding influenced determination of the cause, mechanism, or manner of death.

In two cases, there were histories of alleged malignancy (breast carcinoma and adenocarcinoma of the prostate) which were not identified at autopsy.

Discussion

In this study, scene information was vital in assisting the evaluation of cases. Important features checked by the police were the

plausibility of the circumstances and the statements by witnesses and members of the victim's family. Useful information also included any history of previous suicide attempts, depressive illnesses, the presence of a suicide note, major life events, in- or out-of-hospital psychiatric treatment, and current medication. Any evidence of possible homicidal or accidental hanging was sought (6–9).

External examinations were the next most important step in supporting the conclusion of self-inflicted suspension, with most cases having typical angled parchmented ligature marks around the necks. There were also no features in any of the cases to indicate that the victims had been involved in an assault prior to the hanging episode. Scarring of wrists, when present, was a useful indicator of a previous suicide attempt(s). Specific findings that would have raised suspicions of homicide included any unusual, patterned, or occult injuries not fitting the described circumstances.

In 43 cases, dissection of the neck revealed fractures of the hyoid–laryngeal complex and/or hemorrhage in keeping with compression of the neck (10,11). Although internal examination identified a number of victims with underlying organic diseases, particularly degenerative diseases in the older age group, the majority of these findings were not directly related to the cause and mechanism of death. One of the potentially useful results of internal examination involves cases where significant occult and potentially heritable diseases are identified. In this series, the finding of marked coronary artery atherosclerosis in a 20-year-old man prompted recommendations for medical testing of the victim's family for risk factors such as a familial dyslipidemic syndrome (12). Another function of the internal examination is to confirm or refute the presence of underlying diseases such as cancer that may have precipitated the suicide. In one of these cases, it is possible that carcinoma of the lung may have precipitated the final episode. On occasion, claims by the victim to have been suffering from a malignancy, such as two cases with alleged breast and prostatic cancer, can be disproven.

Despite debate as to the usefulness or not of internal examinations in coronial cases (13–15), this series has shown that it can contribute significant information relevant to the diagnosis of the cause of death. However, routine histological examination of tissues made no significant contribution. This is particularly so given that there are no histological markers of an acute asphyxial event (16). Microscopy either confirmed macroscopic observations or identified diseases or conditions that were incidental to the lethal process. While histological examination of tissues certainly characterized disease better than gross evaluation in this group of suicidal hangings (e.g., by typing the carcinomas), it did not alter or modify conclusions regarding the cause, mechanism, or manner of death. Thus, it is concluded from this study that histological examination of tissue can be omitted from the investigation of uncomplicated deaths resulting from hanging. Similar studies are required to evaluate the contribution of histology to other forms of death.

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