

Autopsy in older medical patients: concordance in ante- and post-mortem findings and changing trends

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ABSTRACT Despite modern diagnostics, the discordance between ante- and post-mortem diagnoses is still around 25%, reiterating the need for high post-mortem rates. In our study, 3.5% had class I errors that, had they been detected during life, would or might have affected short-term outcome. Another 14% had major errors, conditions recorded as primary cause of death that were clinically missed or unrecorded but would not have affected the outcome. There has been an unexplained decline in hospital post mortems and more than a third of UK autopsies are now performed under the instruction of the relevant Coroner's office. The UK Coroners' system is currently under judicial and administrative review to improve the speed of and reduce the need for post-mortem analysis.

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INTRODUCTION

The term 'autopsy' is derived from the ancient Greek word *autopsia*, meaning to see for oneself (*autos*, 'oneself'; *opsis*, 'eye'). Ancient Egyptians were one of the first civilisations to examine human internal organs during the religious practice of mummification around 3,000 BC.

The principal aim of an autopsy is to determine the cause of death and the appropriateness of medical management before death. As early as 1910, William Osler found after performing autopsies that clinical diagnoses were wrong in 40% of cases. Since then the discrepancy between ante-mortem and post-mortem diagnoses has been replicated many times.^{1–7}

The aim of this study was to complete a small audit of local practice to identify the indications for autopsy and to compare ante-mortem and post-mortem diagnoses in hospitalised elderly medical patients.

METHODS

We included consecutive post mortems performed on elderly patients (over the age of 75 years) who died in our hospital in 2007. We obtained permission from the local Coroner to go through relevant post-mortem reports. We collected data on age, sex, ante-mortem clinical diagnosis, indications for a post mortem and the final post-mortem diagnosis. We identified two types of post mortems for discussion, namely the Coroner's post mortem (where a post mortem was requested following discussion with the Coroner) and the hospital post mortem (also called clinical necropsy, requested for clinical reasons without involving the Coroner). To obtain literature for discussion we searched the Medline database for English-language articles (1966–2009) using

TABLE 1 Reasons for a Coroner's post mortem performed for medico-legal purposes

Indication for Coroner's referral	Number
Falls with fracture	9
<i>Clostridium difficile</i> infection	7
Methicillin-resistant <i>Staphylococcus aureus</i> infection	5
Non-injurious falls	4
Drug overdose	3
Falls with subdural haematoma	3
Occupational lung disease	2

TABLE 2 Conditions that were not diagnosed ante mortem

Diagnoses	Number
Myocardial infarction	7
Ischaemic bowel	5
Pulmonary thromboembolism	5
Bronchopneumonia	4
Ruptured thoracic aortic aneurysm	1

the words 'post-mortem diagnoses', 'ante-mortem diagnoses', 'autopsy' and 'medico-legal'.

RESULTS

There were 1,087 hospital deaths in total (including all age groups) during the calendar year 2007. Post-mortem examinations were carried out in 262 patients. All examinations were Coroner's post mortems. There were no hospital clinical post mortems. There were 310 deaths in elderly medical patients (above the age of 75), of whom 86 (28%) underwent post-mortem examination. There were 28 males and 58 females and the mean age was 82 years.

Fifty-three post mortems (62%) were completed because the physician was 'unable to determine the cause of death'. Thirty-three post-mortem examinations (38%) were completed for 'medico-legal reasons' following discussion with the Coroner. The reasons for a Coroner's post mortem for medico-legal purposes are listed in Table 1. Concordance between ante-mortem and post-mortem diagnoses was seen in 64 patients (74%), which is consistent with other studies reported in the literature.²⁻⁷ Unsuspected medical conditions relevant to death that were suggested by post-mortem examination and were not recorded as known during life are shown in Table 2.

Discordance between ante-mortem and post-mortem diagnoses was mainly seen in patients who died suddenly. Conditions that could possibly have led to sudden death included acute myocardial infarction, acute pulmonary embolism, ruptured thoracic aortic aneurysm and ischaemic small bowel. Two patients who potentially died of pulmonary thromboembolism were noted to not have been receiving thromboprophylaxis. In the majority of the medico-legal post mortems, the pathologist had suggested death was due to natural cause. In a few cases, factors contributing to death were deferred until a formal inquest.

These data were presented at a hospital clinical conference attended by the Coroner. Of the analysis of unexpected sudden deaths it was felt that strict adherence to thromboembolic prophylaxis may have had an impact on only two deaths.

The local Coroner's Office has not changed policies regarding post-mortem procedures, but a list of conditions that might be best discussed with the Coroner before issuing a death certificate has been placed for reference in the local hospital office.

DISCUSSION

Discrepancies between ante-mortem and post-mortem diagnoses are well known and have been documented repeatedly in the literature. Many studies have tried to sub-classify the severity of such so-called 'errors'.⁸ Major errors are defined as clinically missed or unrecorded diagnoses involving a disease that may be a primary cause of death. Class I errors are major errors that, had they been detected during life, would or might have affected short-term outcome.

In this study we only identified three class I errors (3.5%), namely two patients who were presumed to have died of acute pulmonary thromboembolism (who were not receiving thromboprophylaxis) and one patient with suggested unrecognised bronchopneumonia. There were suggested to be 12 major errors in ante-mortem diagnosis (14%). However, in some cases it would be difficult to classify the missed diagnoses as errors due to

the paucity of clinical features, especially in the presence of multiple co-morbidities. Moreover, a terminal event might have happened just before sudden death, making it difficult to diagnose the condition ante mortem. One review reported a class I error rate of 10.2% and a major error rate of 25.6%.⁹ Regression analysis from that review showed an inverse correlation between the post-mortem rate and error rate (lower post-mortem rates show higher error rates due to selection bias).

It is not absolutely clear that there is a change in the rate of diagnostic errors with advances in the application of repeated testing. However, one report with high and nearly equal post-mortem rates spanning three decades has shown a significant decrease in major errors over time.¹⁰ The reasons for this are not clear, but an increase in diagnostic accuracy was linked mainly to those deaths due to cardiovascular disease. This may be due to an increase in diagnostic procedures and improved diagnostic tools. A systematic review of 53 distinct autopsy series over a 40-year period has shown statistically significant decreases in diagnostic errors (19.4% relative reduction for major errors and 33.4% relative reduction for class I errors per decade).¹¹

Achieving a correct diagnosis is a complex process involving clinical cognition and diagnostic tests. This process is strongly influenced by recent and remote experiences leading to cognitive bias, which could occur at all steps of the diagnostic process.¹² One study suggested four kinds of errors that could lead to diagnostic inaccuracy, namely omission, premature closure, inadequate synthesis and wrong formulation.¹³ Omission and inadequate synthesis were negatively correlated with the degree of training of the treating physicians and led to false negative diagnoses. But premature closure was independent of clinical experience and correlated with overconfidence in findings.

However, despite the highest levels of clinical skill and multiple diagnostic support, it would be unrealistic to expect no error in ante-mortem diagnoses. Clinical diagnosis is a skill with variable application set by the ability of the clinical team involved, and diagnostic testing at the highest levels is fallible. Regular review of post-mortem diagnoses is a time-honoured way to realise this limitation. It has to be appreciated that post mortems do not always give an absolute or even 'the correct' diagnosis and might fail to establish the cause of death in 1-5% of cases. This is regularly higher in perinatal deaths.⁹ There is often disagreement among pathologists completing examinations over the cause of death. Few studies have formally addressed concordance among pathologists, which is a major problem. One small study found excellent concordance in identifying the principal cause of death but only moderate concordance in establishing the immediate cause of death.¹⁴

Four conditions have been deemed to be essential for a post-mortem to be a valid monitor of clinical performance: a high post-mortem rate, standardised procedures during calculations of both sensitivity and specificity and an estimate of errors in post-mortem diagnoses.¹⁵ The need for up-to-date facilities and the wider availability of diagnostic tools to bring post-mortems to the same standard as clinical diagnostics has been recognised for a long time.¹⁶

Post-mortem rates have steadily decreased across the world. From the point of view of confirmation of ante-mortem diagnoses this is a major concern. In the UK system there has been a fall in both those instructed by the Coroners' system and hospital clinical post-mortems. The latter have for most purposes almost ceased in the past 20 years. A hospital study from the UK showed an overall post-mortem rate of 13.4%, of which 9.9% were medico-legal and 3.5% were hospital post-mortems.¹⁷ Another study from primary care showed a post-mortem rate of 11.7% from 651 deaths over a four-year period.¹⁸

While every hospital or community death most certainly does not require post-mortem verification, the singular cause for a decline in post-mortems is due to a massive decline in clinical hospital post-mortems. In one study hospital post-mortems had fallen from 25.8% in 1979 to 3.9% in 2001, while Coroner's post-mortems had only fallen from 16.8% to 11.4%.¹⁷ Another study revealed a decline in hospital post-mortems from 8.4% in 1997 to 1.4% in 2003.¹⁹ This parallels the data from the US, where there has been a dramatic decline in post-mortem rates for all non-forensic deaths (hospital post-mortems) from 30–40% in the 1960s to only 6% in 1994.⁹

What are the reasons for low post-mortem rates? The major reason for the decline in hospital post-mortems is unclear. The rates of approach following death are not recorded and the willingness of medical staff to address post-mortem examination may be affected by changing social perceptions. There may be confused thinking over gaining the trust and permission from families to agree to post-mortem examination, following media attention surrounding inappropriate organ retention after death. Predictably, the need for post-mortem examination comes at a time when the clinician may be unsure of the reaction of the families at this juncture. Clinicians may be increasingly reluctant to discuss the subject of a post-mortem.

In one study, more than 80% of relatives felt that the deceased had 'suffered enough'²⁰ and did not wish to 'inflict further injury' to the dead. Another study showed that a large number of relatives were distressed by the requests for a post-mortem.²¹ Recently, getting consent has become a lengthy process, which again discourages clinicians from requesting post-mortems.

While there is little evidence to suggest that identifying a missed diagnosis is a reason for physicians' reluctance to seek a post-mortem, this is an obvious reason for declining rates. Only one study has addressed the issue of litigation following post-mortem findings.²² A review of 176 post-mortems identified only one litigation, but the intent to proceed to litigation was present even before the patient's death.

One study has suggested a slight increase in the hospital post-mortem rate (1.4% to 2.4%) might be obtained by appointing a 'pathology liaison nurse' to facilitate discussion and the approach to families by an individual not directly involved in the care of the living nor indeed in the post-mortem examination.¹⁹ Recently, Horowitz suggested a centralisation of autopsies with modern facilities as a practical approach to a difficult problem.²³ However, this approach is controversial and may not be applicable to a district general hospital setting in the UK.¹⁶ The Royal Colleges' joint working party suggested a minimum random sample of 10% of all adult deaths for post-mortem (for audit purposes) and an overall rate of 35% as adequate nearly 20 years ago.²⁴ The contemporary relevance of this figure is unclear and the framework of new legislation planned to reform the Coroners' system is not based on a clear numerical rationale. The widespread availability of newer diagnostic systems might influence the need for examination, but by what degree is uncertain. The suggested role for a virtual post-mortem using magnetic resonance imaging techniques has little evidence base for its efficacy compared with formal examination.

It is very clear that if current trends continue, hospital clinical post-mortems could be a rarity in the future. In cases of diagnostic uncertainty at the time of death clinicians should not guess to certify a cause of death but should seek a formal post-mortem. The use of non-invasive imaging modalities following death and limited post-mortems (such as biopsies from specific organs) might be an alternative option in cases where families are not keen for a post-mortem examination, but any such strategy must have a formal evidence base.

CONCLUSION

The concordance between ante-mortem and post-mortem diagnosis in our study (74%) is consistent with other studies. Despite modern diagnostics, the discordance between ante- and post-mortem diagnoses is still significantly high, reiterating the need for high post-mortem rates. There has been a rapid decline in hospital post-mortems and the majority of autopsies are now Coroner's post-mortems.^{17–19}

The higher post-mortem rate in our study reflects the local practice, as Coroners differ in their thresholds for requesting post-mortems. Post-mortem examinations as a part of a Coroner's enquiry are being increasingly

recommended.²⁵ More than a third of post mortems in this study were performed for medico-legal reasons. This is likely to increase in the future with an increase in the

elderly population, who are likely to suffer from conditions that would warrant a post mortem, such as falls, fractures and hospital-acquired infections.

REFERENCES

- 1 Saad R, Yamada AT, Pereira da Rosa FH et al. Coronary artery disease. Comparison between clinical and autopsy diagnoses in a cardiology hospital. *Heart* 2007; 93:1414–9. doi:10.1136/hrt.2006.103093
- 2 Gibson TN, Shirley SE, Escoffery CT et al. Discrepancies between clinical and post-mortem diagnoses in Jamaica: a study from the University Hospital of the West Indies. *J Clin Pathol* 2004; 57:980–5. doi:10.1136/jcp.2004.016246
- 3 Spiliopoulou C, Papadodima S, Kotakidis N et al. Clinical diagnoses and autopsy findings. A retrospective analysis of 252 cases in Greece. *Arch Pathol Lab Med* 2005; 129:210–4.
- 4 Sington JD, Cottrell BJ. Analysis of the sensitivity of death certificates in 440 hospital deaths: a comparison with necropsy findings. *J Clin Pathol* 2002; 55:499–502.
- 5 Cameron HM, McGoogan E, Watson H. Necropsy: a yardstick for clinical diagnoses. *BMJ* 1980; 281:985–8. doi:10.1136/bmj.281.6246.985
- 6 Cameron HM, McGoogan E. A prospective study of 1152 hospital autopsies: I. Inaccuracies in death certification. *J Pathol* 1981; 133:273–83. doi:10.1002/path.1711330402
- 7 Cameron HM, McGoogan E. A prospective study of 1152 hospital autopsies: II. Analysis of inaccuracies in clinical diagnoses and their significance. *J Pathol* 1981; 133:285–300. doi:10.1002/path.1711330403
- 8 Goldman L, Sayson R, Robbins S et al. The value of the autopsy in three medical eras. *N Eng J Med* 1983; 308:1000–5.
- 9 Shojania KG, Burton EC, McDonald KM et al. *The autopsy as an outcome and performance measure*. Evidence report/technology assessment No.58. Rockville, Md: Agency for Healthcare Research and Quality; 2002.
- 10 Sonderegger-Iseli K, Burger S, Muntwyler J et al. Diagnostic errors in three medical eras: a necropsy study. *Lancet* 2000; 355:2027–31. doi:10.1016/S0140-6736(00)02349-7
- 11 Shojania KG, Burton EC, McDonald KM et al. Changes in rates of autopsy-detected diagnostic errors over time. *JAMA* 2003; 289:2849–56. doi:10.1001/jama.289.21.2849
- 12 Kassirer JP, Kopelman RI. Cognitive errors in diagnosis: instantiation, classification, and consequences. *Am J Med* 1989; 86:433–41. doi:10.1016/0002-9343(89)90342-2
- 13 Voytovich AE, Rippey RM, Suffredini A. Premature conclusions in diagnostic reasoning. *J Med Educ* 1985; 60:302–7.
- 14 Veress B, Gadaleanu V, Nennesmo I et al. The reliability of autopsy diagnostics: inter-observer variation between pathologists: a preliminary report. *Qual Assur Health Care* 1993; 5:333–7. doi:10.1093/intqhc/5.4.333
- 15 Saracci R. Is necropsy a valid monitor of clinical diagnosis performance? *BMJ* 1991; 303:898–900. doi:10.1136/bmj.303.6807.898
- 16 Stuart AE. Postmortems: an Edinburgh perspective. *J R Coll Physicians Edinb* 2009; 39:379. doi:10.4997/JRCPE.2009.421
- 17 Burton JL, Underwood JC. Necropsy practice after the 'organ retention scandal': requests, performance and tissue retention. *J Clin Pathol* 2003; 56:537–41. doi:10.1136/jcp.56.7.537
- 18 Khunti K. Referral for autopsies: analysis of 651 consecutive deaths in one general practice. *Postgrad Med J* 2000; 76:415–6. doi:10.1136/pmj.76.897.415
- 19 Limacher E, Carr U, Bowker L et al. Reversing the slow death of the clinical necropsy: developing the post of the pathology liaison nurse. *J Clin Pathol* 2007; 60:1129–34. doi:10.1136/jcp.2006.044420
- 20 Hinchliffe SA, Godfrey HW, Hind CR. Attitudes of junior medical staff to requesting permission for autopsy. *Postgrad Med J* 1994; 70:292–4. doi:10.1136/pgmj.70.822.292
- 21 Start SD, Sherwood SJ, Kent G et al. Audit study of next of kin satisfaction with a clinical necropsy service. *BMJ* 1996; 312:1516.
- 22 Nichols L, Aronica P, Babe C. Are autopsies obsolete? *Am J Clin Pathol* 1998; 110:210–8.
- 23 Horowitz RE. Autopsies: an exercise in futility? *J R Coll Physicians Edinb* 2009; 39:194–5.
- 24 Joint Working Party of the Royal College of Pathologists, the Royal College of Physicians of London and the Royal College of Surgeons of England. *The autopsy and audit*. London: Royal College of Pathologists; 1991.
- 25 Ruddy GN, Duerden RM, Carter N et al. Are Coroners' necropsies necessary? A prospective study examining whether a 'view and grant' system of death certification could be introduced into England and Wales. *J Clin Pathol* 2001; 54:279–84. doi:10.1136/jcp.54.4.279

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