Occasional articles

The changing practice of pathology

N K Shinton

The beginnings of pathology

Pathology is the study of deviation from normal health. It has been studied from the time when man first began to reason on the disorders which affected him. Its separation from medicine in general began with enquiry into the causes of disease and the early history of pathology has been described by Long.¹

During the 5000 years of Egyptian dynasties around three quarters of a billion human bodies were embalmed but no anomalies were recorded. Later, during the fourth and fifth centuries, BC, the Greek school of Hippocrates developed a philosophy of humoral pathology, which suggested a mechanistic concept of disease in place of mythology. Various Roman doctrines of pathology followed in the first century, BC—the pneumatists, the methodists, and the eclectics. These early ideas of disease were formed at a time when dissection of the body was regarded as a desecration and not permitted.

A total change of outlook came with the Renaissance when necropsies were permitted and printing vastly widened the dissemination of knowledge. In the 18th century pathology was a branch of anatomy—morbid anatomy, most gross anatomical lesions being simply described.

The microscope was invented in the 16th century but was not sufficiently refined for tissue to be studied until the early 19th century. This was associated with new techniques of fixation, embedding, microtome cutting, and staining. Cellular pathology was thus established.

Bacteriology developed in parallel, allowing the pathogenic process to be recognised and chemistry, previously a fundamental science, also came to be applied to medicine alongside physiological concepts of disease during the 19th century.

Early pathology practice

Great advances in the science of pathology were made in the latter half of the 19th century, but there was little demand for the services of pathologists outside university centres where necropsies were regularly performed as part of the teaching curriculum.² In most hospitals at this time, simple chemical tests on urine and microscopic examination of blood and urine were performed in ward side-rooms by clinicians. Clinical pathology laboratories were being developed at the turn of the century. The range of tests was limited to

blood cell counting, chemical analysis and cell counting of urine, bacterial staining and culture of urine, sputum, cerebrospinal fluid, swabs, stools and blood, and the serological Wassermann reaction for syphilis. Clinical pathologists performing this work earned their living as clinicians in medicine by private practice from consulting rooms, which often included a small laboratory staffed by a laboratory assistant. Specimens were either collected on site or posted and a report dispatched, together with a bill for the appropriate fee. A good deal of time was also spent on allergy testing, desensitisation, and vaccination. This was the subject material for a play by George Bernard Shaw, *The Doctor's Dilemma*.³ Large hospitals were soon to appoint paid laboratory directors.

Towards a national pathology service

In 1911 the Lloyd George National Insurance Act whereby 15 million workers became entitled to "free" medical services was passed. "Panel" patient pathology was performed either by: venereal disease clinics; County Council laboratories; insurance committee arrangement with hospital pathology—for (a) payment by patient, (b) lump sum payment; arrangement with general practitioners for supply of vaccines (paid by the NHI) plus investigations; commercial laboratories (pathology institutes).

After the First World War there was little change in pathology practice. Pathologists either worked in university departments; as part-time hospital pathologists making a living from a mixture of hospital pathology, public health work, coroners' post-mortem examinations and private practice: or exclusively in private practice. Their standing with their consultant colleagues was low. Ledingham, chief bacteriologist at the Lister Institute, described pathologists as "hewers of wood and drawers of water".⁴ A leading article in *The Lancet* at the time condemned "slot-machine pathology" and "sending things down the road and having answers back on pieces of paper".⁵

However, pathologists were making proposals. Delepine suggested in 1921 that there should be a large national laboratory for preparation of standard reagents and antisera, a network of public health laboratories and hospital clinical pathology laboratories.²

Dyke emphasised that efficient diagnostic pathology for the patient could only be achieved

This is an abridged version of the Presidential Address given by Professor N K Shinton to the Association of Clinical Pathologists, London, 3 October 1991.

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Accepted for publication
13 January 1992

ieved by the closest possible contact between patient and pathologist and also between the clinician and the pathologist.⁶ To achieve this every general hospital required a clinical laboratory on site and a trained pathologist to run it. The range of work under discussion was still mainly bacteriological diagnosis, but now with the addition of blood sugars and glucose tolerance tests, following the introduction of insulin in 1925. The diagnosis of pernicious anaemia and its treatment with liver in the diet soon required red cell sizing, gastric analysis, serum bilirubin and reticulocyte counting. Surgical biopsies were also entering routine practice.

The most important deficiency was an organised body to represent hospital pathologists. To correct this, The British Pathologists' Association was formed, later to become the Association of Clinical Pathologists (ACP). The heads of university departments were approached but they were satisfied with their status quo. The aims of the new Association were "to develop the application of pathology in relation to medicine and to protect the interests of those engaged in its study and practice".

One external event changed the organisation of pathologists in the 1930s—the Local Government Act of 1929. This transferred the poor law hospitals from boards of guardians to the local authorities. The London County Council decided that each hospital should have its own clinical laboratory.

The onset of the Second World War brought about striking changes in the practice of pathology. In preparation for bacterial warfare or widespread epidemics from overcrowding, the government, through the Medical Research Council, planned an emergency public health laboratory service which became the Public Health Laboratory Service (PHLS). In addition, a nationwide pathology service became part of an Emergency Medical Service. This was the critical turning point for clinical pathology in the United Kingdom. The country was divided into twelve regions and the professors of pathology in provincial universities became Honorary Regional Advisers in Pathology. Purpose-built and converted clinical laboratories staffed by pathologists and biochemists were developed. Many clinicians and most general practitioners were hence provided with a pathology service that they had never known before. In Dyke's words "a national service in clinical pathology".⁷ Another war-time consequence was the emergence of a National Blood Transfusion Service.

Pathology in the National Health Service

After the War, the foundation of the National Health Service (NHS) resulted in British pathology being differently organised from that in Europe and America. In accordance with the NHS Act consultant pathologists had equal status, with the same terms and conditions of service, including salary, as any other consultant. Clinical pathology became "a growth industry" with a 10% increase per annum in

staff. Most new consultant pathologists opted for whole time contracts which avoided constraints from clinical colleagues wanting a special service for themselves. Furthermore, consultants were contracted to a regional health authority and so were independent of local influence. Apart from some large university hospitals, histopathology and clinical pathology (bacteriology, haematology, and biochemistry) were linked within a single department, often in a converted building, usually under a director. Departments of biochemistry emerged in all large hospitals with either a clinical pathologist or a non-medical scientist at its head. Another important development was the emergence of the *Journal of Clinical Pathology* in 1947 under the editorship of Gordon Signy (fig 1).⁸

A great stimulus for the expansion of pathology practice was the ever increasing range of laboratory tests. These included detection of Rhesus and other blood group antibodies by the Coombs' test with compatibility testing before blood transfusion; the one-stage prothrombin time to monitor anticoagulation; protein electrophoresis; and Whitfield's flexible tube which allowed samples for analysis to be separated by an air bubble. This latter development became the forerunner of the automated methods for estimation of urea, glucose, and haemoglobin. This automation allowed for a much larger number of estimations to be made each day and removed drudgery from technical staff. Blood counting, however, continued to be by hand, with emphasis on the blood film. Histopathology and bacteriology continued much as before, with improved staining techniques.

The Golden Age of British pathology

The foundation of the College of Pathologists in 1962² was to have a profound influence on the practice of pathology in the United Kingdom, and indirectly, in Commonwealth countries. The inception of the examination inevitably indicated the areas of training with

Figure 1 Dr Gordon Signy, from *Trends in clinical pathology: Journal of Clinical Pathology*.

an ongoing effect on practice. At that time most pathologists were general pathologists practising all four branches—chemical pathology, haematology, microbiology and morbid anatomy with histopathology so that trainees had to gain experience in all four branches.

An important development was the recognition of haematology as a laboratory specialty. Until the post-war era, haematology had largely been a subspecialty of clinical medicine but the new investigations vastly increased its laboratory aspect. Dacie (fig 2) proposed “a pipe-dream wild and impractical—a department of haematology in each hospital” with linking of laboratory and clinical haematology.⁹ It followed that when the RCP moved to recognition of specialty training in 1972, haematology was included within the Joint Committee for Higher Medical Training.¹⁰ It was anticipated that both chemical pathology and medical microbiology would follow but this did not occur.

Towards the end of the 1960s, the then Ministry of Health issued a number of reports concerning the practice of pathology. That on the *Organisation of medical work in hospitals*¹¹ established the Division of Pathology, with an elected chairman, in each large hospital. The Zuckerman report to the Department of Health and Social Security (DHSS) on *Hospital Scientific and Technical Services* established the place in hospital medicine of the non-medical scientist.¹² The place of the pathologist was confirmed in a subsequent Health Service circular (HSC (IS) 16) which established the principle that the head of department must be a medical consultant or non-medical scientist of equivalent standing.¹³ Another development from the Zuckerman report was the introduction of regional scientific committees, with an executive Regional

Scientific Officer (RSO), which led to planned regional development of pathology with raised standards of practice. Another outcome of the Zuckerman report was the formation by the DHSS of a Laboratory Equipment and Methods Advisory Group (LEMAG), the forerunner of the Laboratory Developments Advisory Group (LDAG). Much of the work of these committees comprised evaluation exercises at selected centres of new equipment and reagents. LDAG also supervised the introduction of data processing to clinical chemistry and haematology. Other outcomes of the Zuckerman report were the Supra-regional Assay Services (SAS) funded centrally for the performance of assays required infrequently, and the National External Quality Assessment Schemes. In 1975 a Joint Committee between DHSS and the professional bodies agreed that quality assessment in pathology must be an educational exercise. Persistently poor performers were, however, identified by organisers of schemes and the results forwarded to an advisory panel for each discipline. A 95% laboratory participation rate was established and annual reports showed considerable improvement in analytical results. The various schemes were subsequently brought together under the Advisory Committee for the Assessment of Laboratory Standards (ACALS). Pathology was well ahead of other medical specialties in quality assurance.

While these administrative changes were taking place, the technology of clinical chemistry and haematology was changing. The introduction of plastic bags for donor blood permitted separation of platelets and plasma. This increased the safety from contamination but sadly increased the transmission of as then unknown viruses. Automation of most clinical chemistry analytes and of blood counting permitted the introduction of screening for disease and of profile testing. When a patient was seen in outpatients or admitted to hospital, specimens for an agreed test profile were collected routinely—opportunistic screening.¹⁴ This increased the number of venepunctures resulting in the army of “vampires” descending on the wards every morning—the phlebotomists which swelled the numbers of laboratory staff requiring supervision. The NHS, in parallel with the Civil Service, developed laboratory staff grading from senior technicians to chief technicians ending at the top in a principal technician if more than 65 staff were being supervised. The urge to increase staff was inherent in the system, so instead of decreasing numbers with automation they expanded. The new staff required training so there was a burgeoning of courses in pathology at technical colleges which was good for the dissemination of knowledge of pathology.

The 1970s saw a great expansion in hospital building, the district hospital programme, each with its own laboratory. Building guidelines for pathology were developed by the Ministry aided by Gordon Signy as chairman of a combined college/ACP committee. This was based on the four disciplines (chemical pathology, haematology, histopathology and micro-

Figure 2 Sir John Dacie.

biology) with some common services. The college structure was being built in bricks and mortar.

Decline of the national pathology service

In 1974 the NHS was due to undergo its first major reorganisation with the introduction of district health authorities and new management structures.^{15 16} One effect on pathology was the appearance of large district scientific committees.

But the Golden Age of pathology was ending. The workload had vastly increased with the workforce necessary to cope with the load. The clinical pathologist became less involved in the bench while at the same time increased automation led to increasing boredom of the technical staff. The laboratory was becoming a factory. Haematologists became more interested in clinical matters, chemical pathologists in administration, while microbiologists and histopathologists trudged on with an increasing labour intensive workload. Many technicians were overtrained for their job and expressed their irritation by requesting more control of laboratories. In an attempt to assuage their frustration the Government introduced the title medical laboratory scientific officer, but this was not sufficient to satisfy the militants. While all laboratories were to some extent involved in these matters, it was those who had an "absent landlord" who suffered most. Pathologists who understood the frustrations and were sympathetic with the MLSO movement made appropriate inter-departmental changes by the introduction of an embryo form of line management.

Associated with the discontent was a realisation of the danger attached to working in hospital laboratories. Tuberculosis in the mortuary was followed by outbreaks of hepatitis B in departments of haematology and clinical chemistry and of salmonellosis in microbiology. A DHSS committee chaired by Sir James Howie (fig 3) prepared *A Code of Practice for Prevention of Infection in Clinical Laboratories and Post Mortem Rooms*¹⁷ which led to internal laboratory procedures being reviewed with changes to safer automatic equipment practices and the provision of special rooms or cabinets for handling infectious material.

The management revolution of the 1980s speeded the decline of British pathology, district, and unit managers seeing the laboratory as an expensive resource. Stratified guidelines by which efficiency could be judged were set up with financial budgeting of departments. This led to numerous management problems.¹⁸ Methods of measuring workload were introduced followed by a series of performance indicators to compare the efficiency of laboratories. Financial restrictions led to reduction in laboratory staff, amalgamation, rationalisation and in a few instances, laboratory closure. Regional capital budgets, which allowed pathology to be developed on a planned basis, were devolved to districts and by them to hospital units with overall reduction in purchase of equipment.

Figure 3 Sir James Howie. "Portraits from memory": *British Medical Journal*.

Another important change in the 1980s was the introduction of dry-stick methods with desk-top analysers.¹⁹ This resulted in an increase in private laboratories with a narrow range of tests, and minimal consultant availability. Retrenchment of pathology in Britain was underway.

Pathology practice in Europe and America

While dramatic changes in clinical laboratory practice had occurred in Britain, comparatively little change in the organisation of pathology practice had occurred in Europe and America.²⁰⁻²⁴ Apart from funding, the principal difference was the continued separation of anatomic pathology, which included histopathology, cytopathology, and necropsy pathology, from clinical pathology, usually termed "laboratory medicine" or in France "clinical biology". Clinical pathology organisation differed from country to country and in some from one region to another depending on historical, cultural, economic and political variations.

University and large hospitals had, as in Britain, monospecialty departments usually with associated research activities. Small hospitals, of which there were many, had multidisciplinary clinical pathology departments. In some countries—Finland, Holland, Denmark, Sweden, and to a lesser extent, Germany, laboratory haematology was a subsection of clinical chemistry, with haemastasiology as a separate discipline. Clinical haematology here mainly dealt with haematological malignancies, linked in Germany and the USA either with oncology or as part of internal medicine. Immunology was split between clinical chemistry, clinical microbiology, or in Scandinavia with transfusion medicine. Outside the hospitals many clinicians ran their own small laboratories attached to their office (consulting

room). In addition, private laboratories were often run by non-medical scientists or in France by "pharmacists". These could be large commercial organisations, offering at low cost, a wide range of analyses with a specialised communication facility but without a medical advisory service. In large departments, requesting, analysis, and reporting was computerised, the whole process being divided between "star" testing (about 35%) and "when possible", the bill taking the difference into account. The staff worked in shifts with analyses being performed day and night on the same equipment. The laboratory had become a reporting or "informatics service" and regarded as a "cost centre".²⁵

But the major difference from the United Kingdom was the source of funding. In the USA, particularly, laboratory income depended entirely on the volume of work being performed, this in turn being controlled by the requesting physician with a budget controlled by diagnostic-related groups.²⁶ The "billing" aspect of laboratories required high computerisation with appropriately high clerical staffing. Due to the number of private laboratories, accreditation and licensing by the College of American Pathologists (CAP) became essential. Satisfactory quality assurance became compulsory for licensing in France, Germany, and the US. With expensive privatisation a high level of litigation followed.

Harmonisation of pathology practice

The 12 countries of the EC agreed in 1987 that movement of goods and personnel throughout the member countries should be possible after 1992.²⁷ For this purpose directives aimed at essential requirements for this harmonisation have been or are being drawn up. The effects of these on pathology practice are likely to be slow, bearing in mind the wide differences in current practice.

Widespread changes consequent on UK government policy embodied in *Working for Patients*²⁸ are already changing British pathology practice more profoundly than anything over the past 40 years. The ethos is to change the NHS from a centrally planned service into a competitive internal market. This has accelerated budgetary management, with deskilling of staff from the highly trained MLSO to the medical laboratory assistant (MLA) who requires training only for specific repetitive procedures. Laboratories are expected to price their tests, enter into contracts with clinicians and general practitioners, and to compete with each other. Large central laboratories are likely to emerge similar to those in Europe and America, with numerous small laboratories near the patient—ward side-rooms, consultants' private offices, and general practitioner surgeries. Pathology practice in Britain will soon be so similar to that in Europe and the US that mandated harmonisation will not be necessary.

Conclusions

Pathology by its nature is and always will be a

part of life itself. Knowledge of its state and processes have developed from observation by the ancient Egyptians through Greek and Roman doctrinal thought, to early investigation by necropsy at the Renaissance. The advent of the microscope brought cellular pathology and microbiology, followed by chemical analysis of blood fluids. Application to medical diagnosis has been largely a 20th century practice, its organisation outside universities and research centres being largely commercial. Some countries like Britain and Sweden have attempted a planned national service, but with altruism being replaced by monetarism this may be seen in the future as an idealistic experiment. Whither pathology? is for crystal-ball gazing but cyclical pointers from the past suggest that the current moves to a competitive market in pathology will be followed by government intervention towards a planned service for patients. And so the practice of pathology will continue to change.

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