Orthopaedic aspects of mediaeval medicine[1]

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The term 'Dark Ages' may be applied more strictly to medicine than to most other aspects of civilization in the centuries after the fall of the Roman Empire. Although with the exception of Galen the Romans contributed little to the advancement of medical knowledge, they were able, with their engineering prowess, to achieve a wealth of public health facilities, not least those for the wounded and crippled – baths, gymnasia and hospitals.

With the fall of their Empire, these skills were lost; and equally there were few intellectual advances. The Byzantines compiled, collected and transcribed medical works, but made few original contributions. Aetius of present-day Iraq and Alexander of Tralles are credited with the use of colchicum for gout, but may indeed have been forestalled by the ancient Egyptians; Paul of Aegina in the seventh century described ganglion, but failed to distinguish it from sebaceous cyst.

He was one who worked on in Alexandria after the Arab invasion which spread like the arms of its own crescent symbol from Spain to the near East. Arabian medicine – these men were Arab in language rather than in race – concerned itself with the collection of Greek medical texts, their translation into Arabic, and then with the addition of original material; but anatomy was neglected, and surgery suffered as a result.

Avicenna the Persian, born in 980 in Bokhara, described and illustrated bold manoeuvres for the reduction of a gibbus, while Abulcasis, who was contemporary with him but hailed from Cordova at the other end of the Arab empire, left some of the best surgical writing of his day, his third book dealing with fractures and dislocations. It was he who employed the motto 'caution' and observed that 'surgical operations are of two kinds, those which benefit the patient and those which usually kill him'. His work did much to raise the standard of surgery and had much influence on mediaeval practice: it was translated repeatedly into Latin, one of the earliest translations being that of Guy de Chauliac.

The Christian Church, for its part, did exhibit a continuing commitment to the care of the sick, and did devote itself to the preservation of texts which were patiently copied out and painstakingly illuminated. But the view that disease was punishment for sin made the search for cures irrelevant; the belief that the body was sacred led to the prohibition of human dissection; and restrictions such as these diverted the best brains away from medicine into more strictly clerical pursuits.

Indeed, the beginnings of surgical progress within Christendom came not from a Church foundation but from the establishment of the lay school at Salerno in the ninth century, even though this school enjoyed friendly relations with the nearby monastery on Mount Cassino. Salerno's influence on surgery derived mostly from Roger of Palermo, whose 'Surgery' of 1080 contains precise indications for the reduction of dislocations; but although it has been claimed that he freed medicine from ecclesiastical influences, his illustrations still show surgery subservient to religion. It would be fairer, therefore, to say that he and the school of Salerno opened a door for monastic medicine to the outside world, and in particular to Arab influence.

The twelfth and thirteenth centuries were a period of speculation, even if not of scientific observation; to this limited extent they mark an advance on the mere gathering and

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translation of sources of the earlier days of Salerno. Moreover, they saw the rise of medical schools at Montpellier and Bologna. Montpellier may have arisen as an offshoot to Salerno; the faculty at Bologna was founded in 1156 in a university in which there was already a strong law school. Theodoric was one of the founders of the surgical school, and original enough in his thinking to declare that suppuration in wounds was unnecessary and undesirable; but his writing gives no evidence that he had practised dissection up to the time when he abandoned surgery in 1266 on being elected Bishop of Cervia.

Within a decade, however, William of Salicet had published a surgical text which showed evidence of some acquaintance with human dissection – as well as distinguishing between arterial and venous bleeding and recording the association of crepitus with fractures. Howorth (1952) also credits him with carrying out nerve suture successfully. From this evidence of the beginning of dissection in Bologna during the 1270s and the fact that the medical faculty did not become independent of the law school until 1306, Singer (1957) has argued that the dissections must have been performed for forensic purposes at the behest of the lawyers.

Of the next generation of students at Bologna, Mondino de Luzzi has been described as the restorer of anatomy. His manual, published in 1316, details the practical steps in human dissection and the reasons (often related to putrefaction and its associated discomforts) why these steps are so arranged. Admittedly he set out to confirm rather than to query Galen. His detail – particularly in the final couple of pages which deal with the limbs – is often perfunctory, and his debased contracted Latin is hard at times to follow; but there is no doubt that he was a practising anatomist, and Guy de Chauliac records that he dissected a good deal. His practice of performing his own dissections would not become widespread for a couple of centuries, and it is ironical that the text of his work, incorporated in Ketham's (1495) 'Fasciculus medicinae', is prefaced by an illustration of the professor of anatomy seated remote from the specimen detailing what will be revealed while an assistant performs the actual dissection (Figure 1A). One curious feature in his work deserves mention; he

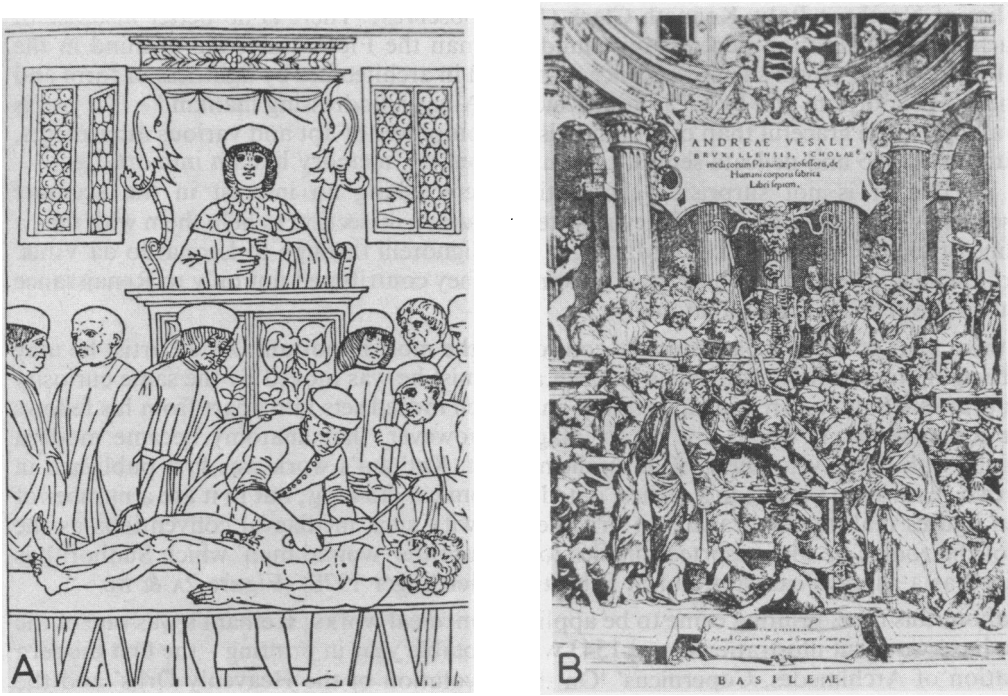

Figure 1. A: Mediaeval anatomy. Frontispiece to the 'Anothomia' (sic) of Mondino, in the 'Fasciculus Medicinae' of Johannes de Ketham (1495). B: Renaissance anatomy. Title page of the 'Fabrica' of Vesalius (Basle 1543)

anticipated the use of staples in surgery, describing the closure of an incised wound by having 'large ants' bite on it and then cutting off their heads!

The name of Guy de Chauliac has already been mentioned, as translator of the 'Tasrif' of Abulcasis and as testifying to Mondino's practice of dissection. He was the son of a French peasant, and studied medicine and theology at Montpellier and under Mondino at Bologna; he later became a physician and Chaplain to three of the Avignon Popes. His 'Chirurgia Magna' (1363) stresses the importance of anatomy to the surgeon and yet its illustrations are mere caricatures – but significantly, in the development of orthopaedics, it advocates the use of continuous traction for fractures of the femur: 'After the application of splints attach to the foot a mass of lead as a weight, taking care to pass the cord which supports the weight over a small pulley in such a manner that it shall pull on the leg in a horizontal direction' (Guy de Chauliac 1363). And Guthrie (1945) the historian comments: 'He also suspended a rope above the bed of the patient so as to facilitate changes of position, a contrivance for which many thousands of patients have since been grateful'.

Some of the hospitals founded in those days still survive. In London, St Bartholomew's was founded by the monk Rahere in 1123 and St Thomas's eighty years later; and in many continental centres spacious buildings with tiled floors, large windows and good plumbing set a standard unmatched since Imperial Rome and until recent years. The benefits of spa treatment were also well recognized, as indeed they had been from antiquity. In a book of poems by Petrus of Eboli, the illustrations give the impression of a community of resort hotels serving the bath houses themselves: where, says Petrus (c. 1250), 'The long standing burden of gout can be shed, and joints can be given repose'.

This same thirteenth century saw the appearance of naturalism in art, which would mature in the fifteenth century. Its development depended on factors as remote as the discovery in AD 1000 by the Arab mathematician Alhazen that light travels not from but to the eye, an appreciation which is fundamental to an understanding of perspective; but its development was in tune with the social and economic attitudes in the fifteenth century republics of Northern Italy. Kenneth Clark (1969) observes: 'There is no better instance of how a burst of civilisation depends on confidence than the Florentine state of mind in the early 15th century'. Given such confidence, expressed in architecture by lightness of form and elegance of proportion, and by an architect such as Alberti, addressing mankind – 'To you is given a body more graceful than other animals, to you power of apt and various movements, to you most sharp and delicate senses, to you wit, reason, memory like an immortal god' – given all this, it is not surprising that artists were taking an interest in the accurate representation in the human form. They resorted to human dissection to help them with this, a long line of them from Verrocchio, Mantegna and Signorelli through to Leonardo da Vinci, Durer, Michelangelo and Raphael; and in doing so they contributed not only to Renaissance art but to the renaissance of anatomy.

Of them all, Leonardo's part must be considered the most important. As an artist he may have been inferior to Michelangelo, but as an anatomist he was moved by the same curiosity which prompted his research in engineering and which indeed sets him apart from his fellows of the Renaissance. It would not do to imagine, however, that anatomy became modern overnight with the development of naturalism in art. Ketham's work was first published in 1491, two years after Leonardo's earliest dated anatomical drawing; but in it are a number of human figures realistically drawn, yet ornamented with such mediaeval conventions as the signs of the zodiac or with assorted missiles to produce the 'wound man' which Sudhoff has described as a surgical caricature of St Sebastian (Herrlinger 1970) (Figure 2A & B).

At about this time, printing came to be applied to medical works; Ketham's was one of the first to have woodcut illustrations; and 1543 was a notable year in printing – the first modern translation of Archimedes, Copernicus' 'On the Revolution of the Heavenly Orbs' and the 'Fabric of the Human Body' of Vesalius. He elected to have this published not in Padua where he was teaching but at Basle, a significant choice because Basle had for some time been a

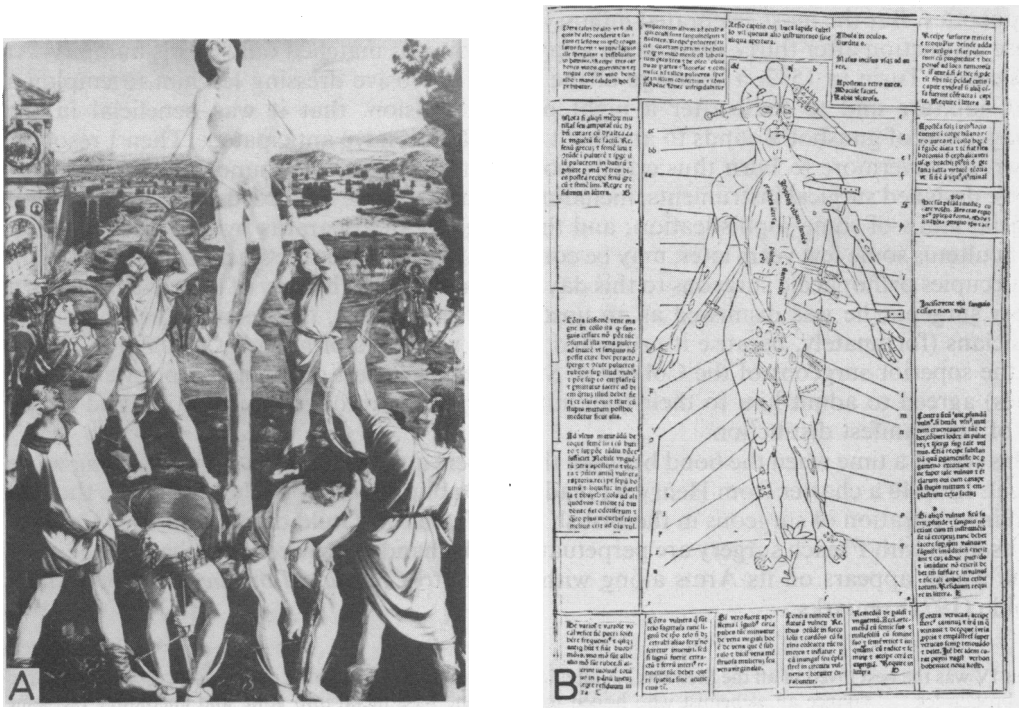

Figure 2. A: The Martyrdom of St Sebastian. Altarpiece for the Oratory of San Sebastiano in the Church of the SS Annunziata at Florence: Antonio (1429–98) and Piero (c. 1441–96) Pollaiuolo. (In the National Gallery, London). B: Wound Man. Illustration in the 'Fasciculus Medicinae' of Johannes de Ketham (1495)

centre of humanism and reform, and here, some sixteen years before, Paracelsus had prefaced his teaching by burning the works of Galen and Avicenna. (For a man born Philippus Aureolus Theophrastus Bombastus von Hohenheim, no less dramatic gesture could have sufficed.)

The 'Fabrica' was intended as a textbook for those who attended Vesalius' dissection classes, that they might 'demonstrate anatomy to others with little difficulty'. Not only the body of the work but the title page itself is notable (Figure 1B): a dissection scene in a typically Renaissance theatre, observed from the balcony above by two figures who have been taken as van Calcar the engraver and his master Titian. But here there is no enthroned mediaeval anatomist; the cadaver is being handled by the anatomists, recognizably Vesalius himself, while his audience press close to observe the parts.

Vesalius' contempory Guido Guidi of Pisa, better known as Vidius, is of interest because, in what Herrlinger (1970) contends to be the most beautiful textbook of surgery to be printed in the sixteenth century, he showed us the instruments, bandages, machines and mechanical operations which had been described as long ago as Hippocrates and Galen, and were still in use at the time.

It was a time in which the innovators were the military surgeons. As early as 1460 a Bavarian army surgeon, Heinrich von Pfolspeundt, had written on wound management – mainly on arrow wounds but with brief reference to bullet wounds and the management of facial injuries; Hieronymus Brunschwig from Alsace had followed in 1497 with a more detailed account of gunshot wounds; and in 1517 came the work of Hans von Gersdorff, who made a significant contribution to orthopaedic progress with his illustrations of screw traction. The application of controlled force, contrasting with the lever or the windlass of his predecessors, represented the first major advance in the early management of fractures since

Hippocrates. But the most celebrated military surgeon of the time was Ambroise Paré, a man whose distinction after thirty years as an army surgeon was matched only by his humility. At the siege of Turin in 1537, a shortage of the typical corrosive dressing led him to employ a bland mixture and to find, after a night of apprehension, that it was beneficial in the management of gunshot wounds to an extent he could not have anticipated. 'Then I resolved [he wrote] nevermore to burn thus cruelly poor men with gunshot wounds' (Paré 1634).

Paré designed surgical instruments, including for the first time on record artery forceps, and artificial limbs of some sophistication; and the designing of apparatus by men such as Paré, and Scultetus some few years later, may be considered to represent the start of the habit which still occupies orthopaedic surgeons to this day. Paré had trained by way of apprenticeship as a barber surgeon; he was dismissed as an upstart by Gourmelen, the dean of the Faculty of Physicians (fortunately, because it prompted him to write one of his most revealing works); and the superior surgeons of the College of St Côme (the oldest of all the corporate surgical bodies) agreed to admit him to their fraternity only after prolonged negotiation and in the face of his manifest distinction.

This was at a time when the bond between the barbers and the surgeons was becoming more formal. In 1446 a charter from Henry VI made the Dublin Guild of Barber-Surgeons the first royal incorporation of surgeons in the British Isles. From this Guild derives the Irish College, and its links with French surgery are perpetuated in the hand borrowed from the College of St Côme which appears on its Arms along with the motto *Consilio Manuque*. In Scotland, as Prebble (1971) remarks,

> 'James IV was the best loved of all the Stewarts . . . intelligent and curious . . . he could pull a tooth, apply a leech and set a broken leg . . . finance an alchemist who hoped to transmute base metal into gold, and encourage the same wretched man in a belief that a pair of artificial wings would transfer him safely from the walls of Stirling Castle to the ground . . . [but] . . . the King's interest in medicine was not limited to the pulling of teeth or to the alchemistic and aeronaeutical experiments of his Italian leech Damian . . . In 1506 James granted a royal charter to a college of surgeons instituted twelve months before by Edinburgh's Town Council'.

(And once again, the hand in the Arms of the Edinburgh College reminds us of its links with French surgery).

Meanwhile royal patronage of surgeons was occurring also in England, where Henry VIII did much to improve the condition of English surgery during the early part of his reign. By an Act of 1511 he introduced licences to practise surgery and under this Act one Thomas Vicary was licensed in 1514. Having cured the King's 'sore legge' in 1527, Vicary became a royal favourite, was Sergeant Surgeon to the King in 1536, and was largely instrumental in the union of Barbers' and Surgeons' companies in 1540, an occasion commemorated by Holbein in the celebrated painting which shows him receiving, as master of the combined company, its Charter from the King.

Vicary was surgeon to St Bartholomew's, and to this hospital – from Padua which had been Vesalius's university – came William Harvey, as physician. In 1616 Harvey became Lumleian Lecturer in Anatomy and Surgery, asserting in his first lecture that 'the movement of the blood is constantly in a circle and is brought about by the beat of the heart'. Twelve years later he published 'De Motu Cordis', giving the evidence on which he had based this assertion. It may seem paradoxical that a discovery in circulatory physiology should be taken as a landmark in orthopaedics, but this work achieved two things which justify such recognition. In the first place certain pathological processes of orthopaedic significance, bloodborne infection for example, became explicable. Harvey (1628) wrote: 'because the contagion being imprinted into the part, it appears that it is from hence carried to the heart with the blood returning and can afterwards infect the whole body.' But more than this he provided a rational physiology of the circulation against which other physiological findings could be correlated; so that with his work in physiology (together with that in anatomy of his predecessor at Padua) there existed a sound basis for the development of scientific surgery, and hence ultimately of orthopaedics as the specialty which it is today.

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