8

Surgery at the Children's Hospitals (cont.)

Apart from the all too frequent cases of disease of the bones and joints, hospital surgeons would see a variety of other problems, sometimes amenable to surgery, sometimes inoperable but, as the century progressed, the latter group would steadily shrink in size. The repair of congenital malformations, a challenge to surgeons since earliest times, shifted from rarely performed, heroic operations to practicable interventions. At paediatric hospitals the correction of hare-lip, cleft palate, and inguinal hernia, was ever more frequently undertaken. At Pendlebury, in 1881, 14 children with hare-lip underwent surgery, only 4 with cleft palate, and none afflicted with herniae which were then usually treated conservatively. By 1900, at this hospital, 33 cases of hare-lip, 19 with cleft palate, and 18 children with herniae, were operated upon (see Table 13). Also, by the end of the century, tenotomy for club foot, and other deformities due to shortening of tendons, had become routine, tonsils and/or adenoids were being removed by the dozens, and life threatening conditions such as strangulated hernia, appendicitis, and intussusception, were beginning to be considered candidates for surgical intervention.

For centuries medical practitioners had attempted to remedy the grossest and the most disabling malformations compatible with survival. The commonest and most obvious of these, hare-lip with or without cleft palate, chronic hydrocephalus, club foot, and imperforate anus, had been recognized since antiquity and, by the mid-nineteenth century, quite a large literature existed on possible forms of treatment. An ancient Chinese text exists reporting a successful operation for the closure of cleft lip as early as 390 B.C.[1] According to M. Perko, the first precise description of a hare-lip operation dates from the fourteenth century, while the more difficult operation for cleft palate was not defined until the sixteenth century. Since the latter type of surgery was very painful and caused extensive bleeding, it was rarely performed until the nineteenth century and, again according to Perko, not successfully until 1816. Hare-lip was far easier to deal with yet, as late as 1868, Holmes indicated that instances of this ugly deformity in adults were still being encountered.[2] Cleft lip, even when bilateral, was quite compatible with normal growth yet it was more usual to operate early in infancy to facilitate suckling and because the malformation was so hideous. Also the operation was relatively simple and safe. Nevertheless by 1860 Athol Johnson had only performed one repair operation at Great Ormond Street, although he would have undertaken another had the parents not refused permission. The first infant did well, but the second one perished of inanition.[3] Holmes does not seem to have done any repairs while at Great Ormond Street, but during the

[1] M. Perko, 'The History of Treatment of Cleft Lip and Palate', *Progress in Pediatric Surgery*, **20** (1986), 238–51; K. Boo Chai, 'An Ancient Chinese Text on a Cleft Lip', *Plastic Reconstruction Surgery*, **38** (1966): 89.

[2] Timothy Holmes, *The Surgical Treatment of the Diseases of Infancy and Childhood* (London: Longmans, Green, Reader and Dyer, 1868), p. 95.

[3] Athol A. Johnson, 'Lectures on the Surgery of Childhood, Delivered at the Hospital for Sick Children, Lecture I', *British Medical Journal*, **i** (1860): 1–4.

1870s the hospital surgeons became more interested in this condition and, by 1899, as many as 24 cases of hare-lip underwent surgery at Great Ormond Street, with 20 successes and the remaining four reported as improved.

Cleft palate was a different proposition. In England the operation was considered so dangerous, painful and difficult in a small child that it was delayed until puberty, when the patient was expected to be co-operative while on the table. With the advent of anaesthesia earlier surgery became practicable and eminently desirable to avoid the severe speech defects associated with cleft palate. By the 1860s, a handful of British surgeons were closing the soft palate in children as young as three years, leaving the cleft in the hard palate to unite on its own. Unfortunately this did not usually occur, so the gap in the bone had to be tackled at a later date. Thereafter, surgeons had the choice of doing the operation in one or two stages. In very young children it frequently seemed advisable to allow a few months, or even years, to elapse after closure of the soft palate before the cleft in the bony part was repaired since the latter, unless very gross, did not interfere much with speech.[4] Lengthy, sanguineous operations leading to post-operative shock were greatly to be feared in the era before blood transfusion was introduced, so the skill of the surgeon and the pre-operative state of health of the child were also important considerations. Furthermore, repair of the hard palate tended to break down in the presence of infection or if the sutures were under tension. Of 38 operations for cleft palate performed at Great Ormond Street in 1899, only 50 per cent were satisfactory. Seven of the remaining patients were only partially relieved, 10 were worse off, and two died.

Imperforate anus of varying degrees of severity also represented a fairly common congenital abnormality but one whose treatment brooked no delay. As A. F. Sharli has shown, until the nineteenth century only minor types of malformation could be treated surgically with success.[5] Simplest of all was mere occlusion of the anus by a membrane which could be incised or even perforated digitally. The more serious situation of an anus closed by skin and subcutaneous tissue was also amenable to surgery before the nineteenth century, although failures were numerous because of complications or because the babies were already in desperate straits by the time medical care was sought. When however the rectum itself was involved in the deformity, being absent, deficient, or obliterated, not much could be done by pushing a trocar blindly into the pelvis and, by the late eighteenth century, colostomy was introduced as a life saving procedure for such seriously afflicted infants.

In 1835 a young Parisian surgeon, J. Z. Amussat, introduced a method of searching for the rectal pouch under direct vision, pulling it down, fixing it to the skin, then opening it to form an artificial anus. For decades only the most skilful surgeons could replicate Amussat's results, while others continued blindly to probe or to perform permanent colostomies. Victorians, however, had an extreme disgust of colostomy, with some parents, according to Holmes, preferring their child's death to his surviving thus mutilated.[6] Consequently Amussat's rectoplasty, or modifications thereof, was sometimes

[4] Henry Ashby and G. A. Wright, *Diseases of Children, Medical and Surgical* (London: Longmans, Green, 1899), p. 173.

[5] A. F. Sharli, 'Malformations of the Anus and Rectum and Their Treatment in Medical History', *Progress in Pediatric Surgery*, **11** (1978): 141–72.

[6] Holmes, *Surgical Treatment*, p. 166.

undertaken but never casually, since even at the end of the nineteenth century most of the babies undergoing this operation could be expected to die of peritonitis or of 'failure of relief'.[7] Inguinal colostomy was easier to perform, but even here the results were poor with only about one-third of patients surviving. In 1880, Edmund Owen reported on five subjects under his care. He lost three of the infants after colostomy because of peritonitis; these neonates had died a few days after surgery. Two other babies survived the operation and did well for three months until he felt impelled, or was persuaded, to attempt the establishment of a more normal perineal anus. Both babies died after the second operation.[8] The reconstruction operation continued to pose problems and, even at the end of the century, was rarely performed in paediatric hospitals. Again using 1899 as an example, in that year only two babies with imperforate anus underwent surgery at Great Ormond Street, one was merely relieved, and the other infant died.

Less threatening to all concerned were congenital limb deformities such as club foot. E. H. Strach points out that the Hippocratic writings recommended early manipulation and fixation of club foot in an over corrected position with bandages.[9] Strach also indicates that until the nineteenth century this condition was mostly treated by bone setters who invented various types of shoes and splints to keep the foot in a more or less normal position. Manipulation was successful in milder cases but not with severe deformity involving contracted tendons. In 1816 Delpech, a surgeon at Montpellier, had recourse to cutting the Achilles tendon, using a 'blind' method to avoid subsequent infection. Instead of cutting the skin overlying the tendon, he made his incisions on either side, then inserted a curved blade through the tissue in front of the tendon which was divided transversely.[10] Although the case was a success, Delpech did not repeat the procedure (perhaps because of unfavourable criticism in Paris) and it was left to the German surgeon, Louis Stromeyer, to perfect the operation of subcutaneous tenotomy. One of his successful patients was the British surgeon, William John Little, who three years later, in 1837, brought Stromeyer's method to London. Subcutaneous tenotomy rapidly became popular, soon being extended to other tendons such as the sternomastoid in 'wry neck'.

Cutting the Achilles tendon did not always cure club foot since, as indicated by Strach, other tissues were often involved in severe deformity. By the last quarter of the century, with the increased security provided by antisepsis and asepsis, more adventurous surgeons were advising the free division of all resisting structures. According to Edmund Owen, surgeon to the Hospital for Sick Children, Great Ormond Street, 'the old treatment consisted chiefly in tenotomy and in the stretching of obstinate ligaments and fasciae; the modern one demands section not only of tendons, but of ligaments, fasciae and all tight bands, forcible rectification and subsequent manipulations and frictions'.[11] Furthermore, for extreme deformity, or after relapse, Owen recommended open operation on the ankle joint as introduced by A. M. Phelps of New York in 1893. But whereas Phelps was prepared not only to divide soft tissue but also to remove a wedge of bone from the calcaneum and to section the neck of the astragalus, British surgeons seem to have

[7] Ashby and Wright, *Diseases of Children*, p. 153.

[8] Edmund Owen, 'Certain Practical Points in Connection with the Surgery of Childhood; Lecture III', *British Medical Journal*, i (1880): 357–9.

[9] E. H. Strach, 'Club Foot Through the Centuries', *Progress in Pediatric Surgery*, **20** (1986): 215–37.

[10] 'The Treatment of Deformities', *British and Foreign Medico-Chirurgical Review*, **28** (1861): 384–408.

[11] Edmund Owen, *The Surgical Diseases of Children* (London: Cassell, 1897), p. 471.

doubted the wisdom of interfering with bony tissue. As so often in surgery, a wide spectrum of thought existed as to the degree of operative interference justified in any case of club foot. About all surgeons were agreed upon was that treatment, conservative or otherwise, should be instituted as soon as possible after birth.

Umbilical and inguinal herniae, or ruptures, usually of congenital origin, were commonplace in children, with boys in particular suffering from the inguinal variety. By 1860 Athol Johnson had seen 66 cases of umbilical hernia at Great Ormond Street (35 in females, 34 in males) and 64 instances of inguinal hernia, of which 54 were in boys.[12] The simplest and most usual treatment was to reduce the contents and then apply some kind of truss to prevent recurrence. This object, usually made of padded leather or rubber (simpler, more easily washable appliances, such as a skein of wool, often sufficed in babies), was supposed to be worn night and day on the principle that the rupture stood a good chance of healing spontaneously in a small child if descent of the hernia were prevented.[13] If sustained use of a truss failed, then surgery to close the gap, or canal, in the abdominal wall might be contemplated. A multiplicity of methods existed, indeed had existed and evolved over the centuries, but permanent cure could prove elusive. In 1860 Athol Johnson made no mention of operation for the radical cure of hernia in his lectures at Great Ormond Street because he considered 'that we are seldom justified in having recourse to an operation, by no means absolutely unattended with danger, to effect that which can usually be accomplished without the slightest risk'.[14] In other words he recommended using only a truss. Antisepsis changed this viewpoint and surgical repair became quite commonplace in paediatric hospitals. In 1899 at Great Ormond Street 19 children underwent surgery considered successful in all cases, although recurrence at a later date could not be ruled out. Operation for the life threatening condition of strangulated hernia also became practicable with the advent of aseptic surgery. In 1899, three such critical operations were performed at Great Ormond Street and all three children recovered.

Although major surgery, apart from amputations, was only rarely performed in children before the advent of anaesthesia, a notable exception was lithotomy or removal of stone from the bladder. The eighteenth-century surgeon, William Cheselden, reintroduced lateral operation for stone, which seems to have been particularly successful in children, that is boys since girls rarely suffered from this acutely painful condition. Cheselden himself reported that of 105 operations he performed on patients under the age of ten years, only three died. His figures were exceptionally good, perhaps because of his unusual skills including the ability to perform a lithotomy in fifty-four seconds, thus minimizing the likelihood of surgical shock.[15] But even more plodding surgeons found that the lateral operation was relatively safe in children, while the mortality rate climbed

[12] Athol A. Johnson, 'Lectures on the Surgery of Childhood, Delivered at the Hospital for Sick Children, Lecture III', *British Medical Journal*, **i** (1860): 61–5.

[13] Walter Pye, 'An Old-Fashioned method of Trussing Ruptured Infants', *British Medical Journal*, **i** (1887): 1152–3, described how a skein of worsted, or softer lamb's wool, could be used to form a comfortable, washable truss for babies. The original account, published in the *Medical Times* for 1848, had been provided by William Coates, of Salisbury, who had seen the method employed to good effect by a 'gude wife' in his neighbourhood.

[14] Johnson, 'Lecture III', *British Medical Journal*, **i** (1860): 61–5.

[15] For the early history of surgical treatment of urinary calculus, see Owen H. Wangensteen and Sarah D. Wangensteen, *The Rise of Surgery from Empiric Craft to Scientific Discipline* (Minneapolis: University of Minnesota Press, 1978), pp. 65–92.

steadily after the onset of puberty to reach about one death for every three operations after the age of 70.

Nevertheless, the mind boggles at the suffering unavoidably inflicted on these children before anaesthesia became available. Bound and trussed like a chicken, the young patient had to endure a staff being passed along the urethra into the bladder, followed by an incision in the mid line of the perineum, between the anus and the base of the scrotum.[16] The operator would then cut laterally and backwards into the ischio-rectal fossa until the staff resting in the bladder was reached. Knife and staff were then opposed and a cut made at the base of the bladder. A finger was inserted through the incision and, if all went well, the stone could be felt. At this point, the staff was removed and forceps introduced over the finger onto the stone, which was then removed via the perineal wound. Ideally, full recovery would occur in ten days to a fortnight, by which time the child would be urinating normally. Since bladder stone caused exquisite pain each time the victim needed to pass water, such patients may have become unusually resigned to suffering and anyway could offer little resistance once surgery was under way.

In his 1868 textbook of surgery, Timothy Holmes claimed to have performed lateral lithotomy in about 20 children with only one death.[17] Eight of these children were patients at Great Ormond Street between 1862 and 1867; all seem to have had smooth recoveries and to have been discharged from three to five weeks after surgery.[18] Sepsis was not a problem, in contrast to its ubiquitous presence in the 1860s after other forms of major surgery. But success had its drawbacks, for British paediatric surgeons, including Holmes, were dismissive of innovations in bladder surgery being introduced from the Continent during the middle third of the century. One such was lithotrity, which involved passing, through the urethra into the bladder, an instrument that could grasp and crush stones. According to the British, this operation was unsuitable for children because their urinary passages could not accommodate a lithotrite large enough to crush most calculi. Only at the end of the century, by which time French and German instrument makers had fashioned lithotrites more suitable for children, did this less invasive form of surgery become acceptable in England. Similarly, another continental innovation, suprapubic lithotomy, which allowed the bladder to be opened under direct vision, remained unpopular for decades in England. 'Against it', according to Wright, 'is the risk of wounding the peritoneum, the risk of urinary infiltration, and the fact of the good results following the lateral operation'.[19] Nevertheless, by 1899, Wright himself had not performed lateral lithotomy for many years; all his cases of stone having been treated either by lithotrity or by the suprapubic operation. His contemporary, Edmund Owen at Great Ormond Street still, in 1897, rejected suprapubic lithotomy as having a poor record in children but was now favourably disposed towards lithotrity when practicable.[20] Nevertheless, operations for the removal of bladder stone were infrequently performed in the paediatric hospitals at the end of the century—only two at Great Ormond Street in

[16] This description is derived from George Allarton, 'Lithotomy Simplified,' *Retrospective of Practical Medicine and Surgery*, **31** (1855): 288–95.

[17] Holmes, *Surgical Treatment*, p. 597.

[18] Great Ormond Street Archives (hereafter G.O.S. Archives), 'Mr. Holmes' Cases, 1862–1867'. Eight cases of lithotomy are recorded during these six years.

[19] Ashby and Wright, *Diseases of Children*, p. 611.

[20] Owen, *Surgical Diseases of Children*, 1897, pp. 300–7.

1899 and four at Pendlebury in 1900—suggesting that the condition was occurring less often in children than formerly.

Fear of inducing peritonitis by accidentally cutting into the peritoneum rendered surgeons wary of suprapubic lithotomy. As Zachary Cope has indicated, the same fear 'made surgeons avoid the opening of the sac of a hernia [even when strangulated], and caused them to prefer to perform colotomy by the lumbar retro-peritoneal route'.[21] Before the advent of asepsis, invasion of the peritoneal cavity, whether accidentally or surgically, was tantamount to a death warrant. So ingrained was the taboo that only gradually, from the 1880s onwards, did surgeons become emboldened to perform operations requiring entry into the peritoneal cavity. Abdominal disorders, such as appendicitis, intussusception (invagination of the bowel), and strangulated hernia, that had previously been treated conservatively, gradually became amenable to surgical relief. In the pre-operative era, children so afflicted had usually died and the few that survived did so only after days or weeks of misery and pain, which would be considerably abbreviated by surgical intervention.

Although today appendicitis is the commonest acute abdominal disorder of childhood, the natural history of the condition was not recognized until the late nineteenth century. More precisely, the term 'appendicitis' was introduced by the American pathologist Reginald Fitz who, in a memorable paper read in 1886 to the Association of American Physicians, indicated that the intra-abdominal abscess previously known as 'perityphlitis' was almost certainly localized peritonitis due to disease of the appendix. He further explained that since 'a circumscribed peritonitis is simply one event, although usually the most important, in the history of inflammation of the appendix, it seems preferable to use the term appendicitis to express the primary condition'.[22] Before Fitz, typhlitis (disease of the caecum) and perityphlitis were terms rather vaguely used to indicate abscess formation in the general area of the appendix. Since cutting into the peritoneal cavity was frowned upon, such abscesses were not opened unless they surfaced under the skin.

Decades before surgeons generally recognized the liability of the appendix to become inflamed and so cause a variety of intra-abdominal disturbances, at least one physician, Charles West, seems to have been aware of this possibility. In *Lectures on Diseases of Infancy and Childhood*, published in 1848, West concluded an account of the causes of 'peritonitis' as follows: 'some notice must be taken of a highly dangerous form of *peritonitis*, circumscribed in some cases, but general in others, which *succeeds to inflammation of the caecum, or of its vermiform appendix*' (emphasis in the original text).[23] He then stated that this affliction was more frequent in adults and that he had seen only one case in a child. The patient, a previously healthy seven-year-old boy, died eleven days after the first signs of abdominal indisposition. Autopsy showed 'gangrene of the mucous membrane of the appendix', associated with local peritonitis and acute pleurisy. By 1865, West reported having seen five cases of peritonitis following inflammation of the caecum or of the vermiform appendix. The first three cases, including the above

[21] Zachary Cope, *Pioneers in Acute Abdominal Surgey* (Oxford: University Press, 1939), p. 81.

[22] Quoted by Sir Zachary Cope, *A History of the Acute Abdomen* (London: Oxford University Press, 1965), p. 35.

[23] Charles West, *Lectures on Diseases of Infancy and Childhood* (Philadelphia: Lea and Blanchard, 1850, from the 1848 London ed.), p. 389.

mentioned boy, ended fatally; the fourth child developed an abscess in the right iliac region and eventually recovered; while the fate of the fifth child was unknown to West. 'The main symptoms', he remarked, 'are the same in all cases'.[24] The outcome however varied. Fatal cases were usually due to generalized peritonitis. More usually, in West's opinion, 'the mischief remains circumscribed to the neighbourhood in which it originated'.[25] Sometimes the inflammation subsided, but more commonly an abscess formed 'which points either in the lumbar or the iliac region'. Recovery from circumscribed inflammation tended to be slow, and fatal complications (such as pleurisy in the little boy described above) remained a hazard. His 1873 analysis remained substantially the same but was now based on eight cases.[26]

West provides an indication as to the fate of afflicted children before appendicitis became more generally recognized and then open to surgical intervention. As he noted in 1865, 'the tendency of the ailment, even when it terminates most favorably [*sic*], is to run a slow course, and unless you could remove the local irritation in which it originated, it would be idle to expect that you could cut it short by heroic measures'.[27] However, surgeons were far from contemplating any 'heroic measures' in the 1860s apart from opening abscesses that had become subcutaneous. In his 1868 textbook, Holmes showed relative indifference to a condition so eloquently described by West, his colleague at Great Ormond Street. The following is the full text of Holmes' account of 'abscess connected with the bowel',

> Of abscess connected with diseased or injured intestine, whether in the ileo-caecal or other region, I have hitherto seen but little in childhood. I have referred to a case above (p. 540), where a large psoas abscess formed near the caecum and burst into both the bowel and the peritoneal cavity; but this seemed to me to be connected with disease of the spine. In some cases foreign bodies lodged in the appendix have been at the root of similar mischief. I think that in such cases, if there be no urgent symptoms, it is better not to interfere; but where there is much pain, constipation, vomiting, or signs of incipient peritonitis, and a swelling (probably in the iliac fossa) leads to the suspicion of an abscess in the subperitoneal tissue, chloroform should be given, and the swelling cut down upon methodically, from a very free skin wound; care being taken to keep as near the ilium as possible, so as to avoid the peritoneum.[28]

The case mentioned by Holmes was a boy of eight years admitted to Great Ormond Street in 1862 with a diagnosis of psoas abscess. The child was extremely ill and died the next day. At autopsy the abscess was found to have perforated internally causing generalized peritonitis, which was not suspected during life. Surprisingly, owing to its common occurrence today, appendicitis could have been the underlying pathology in only one other case admitted under Holmes' care between 1862 and 1867, out of 101 total surgical admissions during the period. This child, a girl of twelve, came in with a lumbar abscess which slowly resolved under conservative care allowing her to be sent home six weeks later.

[24] West, *Lectures* (Philadelphia: Henry C. Lea, 1866, from the 1865 London ed.), p. 534.
[25] Ibid., p. 535.
[26] West, *Lectures* (Philadelphia: Henry C. Lea, 1874, from the 1873 London ed.), p. 546.
[27] West, *Lectures* (1866), p. 536.
[28] Holmes, *Surgical Treatment*, pp. 571–2.

Nor were admissions for 'perityphlitis' any more frequent elsewhere. As late as 1881, there was no record of such a diagnosis for any of the 312 surgical cases seen that year at Manchester Children's hospital, although two of the children, again a very small number, may have been suffering from the effects of appendicitis. Both had abscesses in the groin and stiff painful hip joints. But once the abscesses were opened both boys improved rapidly with no evidence of residual hip joint damage, leading to a retrospective diagnosis of 'abdominal abscess simulating hip disease'. However, children with appendicitis may well have been admitted onto the medical wards as suspected cases of tubercular peritonitis, gastro-intestinal catarrh or even chronic peritonitis. Samuel Fenwick, physician to the London Hospital, referred in 1885 to perforation of the vermiform appendix as an example of 'affections that occur so rarely that only a few instances fall within the observation of any practitioner, and they are consequently apt to be overlooked or confounded with other maladies of more frequent occurrence, whilst the rules for their detection and treatment are necessarily vague or imperfect'.[29] According to Fenwick, when the symptoms were considered to be the result of intestinal obstruction, the treatment was often drastic purgation with fatal consequences. Nor, in his opinion, was the alternative treatment of administering opium any more successful. Instead, impressed by reports from the United States, Fenwick advocated the surgical measure of opening the abscess even if this entailed cutting into the peritoneal cavity.

Increasing numbers of cases of perityphlitis were reported in the medical journals during the 1880s. By the 1890s the term 'appendicitis' had become more usual and surgical intervention was more frequently undertaken, although not to the extent advocated or practised in the United States. British surgeons were amazed at the statistics emanating from across the Atlantic. W. Mitchell Banks, surgeon to the Liverpool Royal Infirmary, commented at the 64th Annual Meeting of the British Medical Association that 'a single American surgeon seems to see more cases in one year than I have in all my life'. From this he concluded 'either that appendicitis occurs in the United States with most astonishing frequency, or that surgeons there operate upon a class of patients who in Liverpool get perfectly well with proper treatment'.[30] But even in more conservative Britain the diagnosis was being made frequently enough for James F. Goodhart, physician to the Evelina hospital from 1875 to 1889, to reflect in 1899 that appendicitis had become 'an appallingly common disease of late years'.[31] Since he could not believe that the disease was formerly 'smuggled away as simple peritonitis or tuberculous peritonitis', Goodhart assumed that appendicitis had truly increased in frequency for reasons that remained unclear.

Turn of the century debates about justification for a diagnosis of appendicitis and also for appropriate treatment, conservative or surgical, illustrated the difficulty of reaching a consensus in any disease whose natural history was indeterminate. Since there was no way of predicting from the initial symptoms whether presumed inflammation of the appendix would abate or proceed to perforation, it was perhaps inevitable that as surgery became safer early operation became more routine. American surgeons were the more daring and

[29] Samuel Fenwick, 'On Perforation of the Appendix Vermiformis', *Retrospect of Practical Medicine and Surgery*, **90** (1885): 68–70.

[30] 'Discussion on the Surgical Treatment of Appendicitis', *British Medical Journal*, **ii** (1896): 997–1006.

[31] James F. Goodhart, 'Opinion the Salt of Fact', *Lancet*, **i** (1899): 209–11.

Thomas Morton of Philadelphia seems to have been the first, in 1888, to remove an inflamed appendix that had not yet ruptured.[32] The following year, Charles McBurney of New York advocated early surgery on the principle 'that one cannot with accuracy determine from the symptoms the extent and severity of the disease'.[33] He realized that the crux of the matter was whether it could be demonstrated by experience 'that the exploratory incision for inspection of the diseased appendix is much more free from danger than the expectant treatment'. Time would tell in favour of surgery, but more slowly in Europe. In 1897, not one single appendicectomy was performed at Pendlebury although 691 other operations were recorded for that year. Three operations for appendicitis were undertaken at Great Ormond Street in 1899, with two recoveries and one death. It would take what Bowman has called 'the influential illness of King Edward VII', in 1902, for intervention to become legitimized in this country.[34]

With intussusception, that is invagination of the bowel most commonly seen in babies, the adoption of direct surgical intervention was also slow and controversial. Diagnosis was relatively simple since the onset of pain and vomiting was usually sudden and accompanied by collapse, the voiding of blood and mucous from the bowel and an abdominal tumour. Left to itself the condition was usually fatal but the medical literature contained scattered reports of recoveries, usually in adults, due to gangrene followed by spontaneous separation of the invaginated gut. Cope suggests that surgery was not undertaken in infants in the pre-anaesthetic era because 'practitioners preferred to await hopefully for this [sloughing away of the intussusceptum] to happen rather than make the dread experiment of opening the abdomen'.[35] The first successful operation in an adult was reported in the eighteenth century but not until 1871 did an infant survive surgery for intussusception.[36] Jonathan Hutchinson performed the operation at the London Hospital and 'found that the serous surfaces did not adhere, and that there was no difficulty whatever in drawing the intussuscepted part out of that into which it had passed'.[37] The child recovered without complications or relapse to be discharged three weeks later. To encourage other surgeons to operate Hutchinson also provided information gleaned from the journals on 130 children with intussusception treated conservatively, including the use of air-insufflation into the lower bowel or of water enemas to effect reduction. Only 33 children, 25 per cent, recovered spontaneously (through gangrene and sloughing of the invaginated bowel) or after insufflation. The prognosis was particularly bad in infants 'scarcely any recovering excepting the few in whom injection treatment is immediately successful, whilst a large majority die very quickly'.

Surgeons were not obviously encouraged by Hutchinson's exhortations; after all he had reported only a single instance of successful abdominal section. Further reports were not forthcoming until 1885 when Frederick Treves, also surgeon to the London Hospital, reiterated the fact that statistics showed spontaneous elimination to be extremely rare in

[32] Stewart M. Brooks, *McBurney's Point: The Story of Appendicitis* (New York: A. S. Barnes, 1969), p. 86.

[33] Charles McBurney, 'Experience with Early Operative Interference in Cases of Disease of the Vermiform Appendix', *New York Medical Journal*, **50** (1889): 676.

[34] A. K. Bowman, *The Life and Teaching of Sir William Macewen* (London: William Hodge, 1942), p. 349.

[35] Cope, *Pioneers in Acute Abdominal Surgery*, p. 56.

[36] Ibid.

[37] Jonathan Hutchinson, 'A Successful Case of Abdominal Section for Intussusception', *Medico-Chirurgical Transactions*, **57** (1874): 31–75.

children under two years of age, only occurring in two per cent of such cases.[38] He recommended surgical intervention, within the first forty-eight hours, if and when reduction by injection failed. Similar advice was proffered by W. McAdam Eccles, who in 1892 reported on 28 cases of intussusception (27 in children) admitted to St. Bartholomew's Hospital between 1871 and 1890.[39] Twenty-five of these patients had been treated since 1881 suggesting an increasing awareness of the condition. One child, a three months old baby girl, was admitted fourteen days after the initial symptoms with sloughing bowel protruding at the anus. She made an excellent recovery without any intervention. Of the remaining 26 children, 4 were not actively treated, with 2 survivors; 9 received fluid injection only, with 5 recoveries; 7 had air inflation or fluid injection followed by laparotomy, with only one recovery; and 6 had laparotomy exclusively with only one survivor. Not figures, one would think, that would encourage anyone to perform surgery, but Eccles was convinced that the appalling results were mainly due to long delay in seeking treatment.

By the 1890s doubts were being raised as to the wisdom of distending obstructed bowel with air or water. Experiments in animals and on corpses of infants suggested that the pressure of liquid or air commonly used to effect reduction was likely to cause rupture of the colon or of the overlying peritoneum. More importantly perhaps, confidence in abdominal surgery was growing with the introduction and perfection of aseptic techniques. Proponents of laparotomy were arguing that this surgery would be more successful if performed early and without the added risks of previous fluid injection. From his experience as surgical registrar at Great Ormond Street, J. D. Mortimer concluded that 'most of the arguments which have been brought forward in favour of early injection apply equally to early abdominal section; and it has been shown both by experiment and otherwise that the latter may succeed when the former fails'.[40] By the late 1890s, both Owen at Great Ormond Street and Wright at Pendlebury were also in favour of early operation. The former now believed 'that the results of the treatment of acute intussusception would be far better if no subject of the lesion had ever been cured by massage and injection'.[41] At his hospital, in 1899, five cases of intussusception underwent laparotomy with only one fatal result. At the Manchester Children's Hospital during 1897 only one case was admitted, also to be treated and cured by abdominal surgery whereas in 1900 five cases were treated surgically with one death and four recoveries. But it would take a few more years of 'experiment' for immediate operation to become the recognized method of treating intussusception. However, this state of affairs would not be lasting either for since the 1960s air enema, now under fluoroscopic control, has been reintroduced for the treatment of this condition and surgery undertaken only if insufflation fails.[42]

[38] Frederick Treves, 'On the Operative Treatment of Acute Intussusception', *British Medical Journal*, **ii** (1885): 389.

[39] W. McAdam Eccles, 'An Analysis of Twenty-Eight Cases of Intussusception', *St. Bartholomew's Hospital Reports*, **28** (1892): 97–105.

[40] J. D. Mortimer, 'On the Treatment of Intussusception by Injection or Inflation; and its Dangers', *Lancet*, **i** (1891): 1144–6.

[41] Owen, *Surgical Diseases of Children*, p. 325.

[42] Jonathan M. Glover, Spencer W. Beasley and Ethna Phelan, 'Intussusception: Effectiveness of Gas Enema,' *Pediatric Surgery International*, **6** (1991): 195–7.

The success of antisepsis also encouraged the performance of surgery to restore function in crippled patients who would formerly have been left to manage as best they could. We have seen how the treatment of club foot expanded from blind subcutaneous tenotomy to open operations on the ankle where surgeons sometimes became over enthusiastic about the removal of deformed tissue. But by far the most popular 'cosmetic' operation to be performed in paediatric hospitals was the straightening of legs bowed, or otherwise deformed, usually due to rickets. The Pendlebury report for 1897 records 90 operations involving deformities, including 58 osteotomies for the correction of genu valgum and curved tibiae. At Myrtle Street, Liverpool, 409 operations, including 33 osteotomies of the tibia or the femur, were reported performed on inpatients for 1899.[43] Neither hospital reported any fatality following these osteotomies.

Osteotomy, involving the cutting of bone with, or without, the removal of a wedge of osseous tissue, was sometimes practised in the early nineteenth century for the correction of severe deformity due to badly united fractures.[44] As usual, sepsis prevented wide adoption of the technique until mid-century when Bernhard von Langenbeck, professor of surgery at Berlin, introduced a subcutaneous method of performing osteotomy through a minute opening in the skin. Sepsis still occurred but was less frequent than after an open operation. Nevertheless, no surgeon enjoyed working blindly, so the unrestricted operation returned with antisepsis. In 1874, Richard von Volkmann of Halle performed the first antiseptic osteotomies, publishing his results in 1875. The same year Thomas Annandale, Joseph Bell and Joseph Lister at the Edinburgh Royal Infirmary, and William Macewen at the Glasgow Royal Infirmary were undertaking antiseptic open osteotomies. A couple of years later, in 1877, H. G. Howse was using the same technique to correct severe genu valgum in children at the Evelina Hospital in London. By the end of 1878, Macewen had performed over 50 open osteotomies (sometimes more than one on the same limb) without a single fatality.[45] He added to the safety of the operation by simply cutting into the shaft of the bone above the condyle rather than using the usual method of opening the knee joint and separating the internal condyle of the femur. Not opening the joint reduced the risk of sepsis and that of damaging the epiphysis necessary for growth of bone. The following year this remarkable Scottish surgeon demonstrated the feasibility of interhuman transplantation of bone, having previously experimented on animals. His source of osseous tissue consisted of wedges of bone removed to straighten rickety limbs. Macewen's first transplant patient was a three-year-old boy admitted to the Glasgow Royal Infirmary in 1878 with extensive osteomyelitis of the right humerus. So severe was the disease that, after drainage, the whole shaft of the humerus needed to be removed, leaving the child with a flail and useless arm. The obvious solution was amputation but Macewen had other ideas. About a year later, in November 1879, he readmitted the boy to perform a transplant operation. Bone was taken from the tibia of a six-year-old rickety child, chopped into fragments, and placed into a groove already made in the recipient's

[43] *Forty-Eighth Annual Report of the Liverpool Infirmary for Children* (Liverpool, 1900), p. 17.

[44] An interesting discussion of the history and nineteenth-century practice of osteotomy may be found in Bowman, *Sir William Macewen*, pp. 167–94.

[45] William Macewen, 'Lecture on Antiseptic Osteotomy for Genu Valgum, Genu Varum, and other Osseous Deformities', *Lancet*, **ii** (1878): 911–14.

arm. As Bowman relates: 'No vestige of the periosteum remained, and the position of the groove into which the transplanted bone was placed had to be carefully calculated on a simple basis of general anatomical relations—a remarkable feat in itself'.[46] Two more transplants were needed but, about a year later, the child could use his previously flail limb and was later able to earn his living as a joiner. This notable surgery took place at the Glasgow Royal Infirmary but, when the Hospital for Sick Children was inaugurated in 1883, Macewen was appointed honorary surgeon.

As usual with any novel surgery, osteotomy for straightening rickety limbs had detractors as well as enthusiasts. French surgeons in particular tended to consider an open operation unjustifiable and to claim good results with mere splinting or the use of special apparatus for the correction of deformity. In severe cases, the French school might resort to manual osteoclasis, where the bone was forcibly straightened, that is fractured, with the child under anaesthesia.[47] But the pressure needed to achieve effective results could lead to detachment of the femoral epiphysis, so endangering further growth of the bone, therefore in Great Britain and in Germany open osteotomy became the preferred operation. Hospital records indicate good results with negligible mortality from the surgery itself. However, a child undergoing osteotomy would be in hospital for about a month and during that time ran the risk of picking up infectious disease with diphtheria and scarlet fever as the most dangerous. Even the less invasive technique of osteoclasis did not avoid this risk since patients usually needed to be hospitalized for treatment of the fractured bone.

Even at the end of the century it was still usual for acute abdominal emergencies in children to be admitted to the larger general hospitals rather than to the paediatric institutions (see Table 14). From the beginning of 1877 to the end of 1897, that is over a period of twenty-one years, the surgeons of University College Hospital treated 42 cases of acute intussusception in children, mostly infants.[48] According to W. McAdam Eccles, 39 children were admitted to St. Bartholomew's with intussusception during the six years 1891 to 1896.[49] During the same period 21 cases of intussusception were treated at Great Ormond Street and only one at Pendlebury. The Scottish surgeon, Joseph Bell, indicated that in Edinburgh urgent cases were usually seen at home by a doctor who was accustomed to sending such acutely sick patients directly to the Edinburgh Royal Infirmary. Thus, children with strangulated herniae were rarely to be seen in the wards of the Edinburgh Children's Hospital. General practitioners, as we have seen, were in favour of the large city hospitals while usually considering the special ones unnecessary. Parents, on the other hand, had grown to prefer the cosier atmosphere prevalent in children's hospitals so, if the child was not too acutely sick, it was more likely to be taken to the outpatient department of a paediatric hospital. 'The less urgent cases of reducible or

[46] Bowman, *Sir William Macewen*, p. 141.

[47] L.-A. de Saint-Germain, *Chirurgie orthopédique . . . leçons cliniques professées à l'Hôpital des Enfants Malades* (Paris: J.-B. Baillière, 1883), pp. 436–72.

[48] Arthur E. Barker, 'Fifteen Consecutive Cases of Acute Intussusception; with Appendix Including all Cases of Acute Intussusception Treated at University College Hospital by the Surgical Staff from the Year 1877 to End of 1897', *Transactions of the Clinical Society of London*, **31** (1898): 58–79.

[49] W. McAdam Eccles, 'An Analysis of a Second Series of Forty Cases of Intussusception', *Saint Bartholomew's Hospital Reports*, **33** (1898): 139–55. The series included one adult female aged 30 years; the remainder were children under 12 years, with 27 under the age of 12 months.

incarcerated hernia', according to Bell, 'find their way at the instance of the mothers to the less crowded waiting room of the Sick Children's Hospital'.[50]

Bell also observed that the two great classes of surgical illness, 'which throng the waiting room, and almost choke the beds', were afflictions of the joints and glandular abscesses. This generalization held good for other paediatric institutions, indicating the high prevalence of tuberculosis in children at the time. For example, at the Manchester Children's Hospital 691 operations were undertaken in 1897. Of these 79 were for the arthrodesis, excision or incision of various joints; 74 involved the scraping, cleaning and splinting of bones where the underlying pathology was tuberculosis or osteomyelitis; 25 involved abscesses of the lymph glands, almost certainly tuberculous; 38 were concerned with abscesses elsewhere; 12 were for the scraping of various tubercular lesions; two were laparotomies revealing tuberculous peritonitis; and one was an amputation of the leg for refractory tuberculous of the ankle; giving a total of 231 operations for tubercular or otherwise septic lesions.[51] Most impressive, however, was the fact that by 1900 the Manchester surgeons no longer needed to amputate limbs, as had been so commonplace a few decades earlier (see Table 13).

By the end of the century Great Ormond Street and Pendlebury were beginning to become specialized in major, non-acute surgery for children. In 1899 the most frequently performed operations at Great Ormond Street continued to be the scraping or removal of tuberculous glands (68 out of a total of 495 'major' operations), also incising and scraping for infection of the mastoid bone (46 cases) and of the hip joint (45 cases). But next in frequency were attempted repairs of cleft palate (38 cases) of which half were reported as successful and seven as providing some relief (see Table 12). As may be seen from Table 14, neither St. Bartholomew's nor St. Thomas's were dealing with anything like the same number of children requiring surgery for cleft palate or for hare-lip. In 1900, 19 operations for cleft palate and 33 for hare-lip were undertaken at Pendlebury while, as in most of the other children's hospitals, the figures for acute abdominal surgery remained low.

Most frequently performed was minor surgery for conditions peculiar to children, that is circumcision and the removal of tonsils and adenoids. The latter intervention seems to have become popular in the 1890s. At Pendlebury only one tonsillectomy was performed in 1888 but, by 1900, the number undertaken had escalated to 141. Recurrent attacks of acute tonsillitis and chronic enlargement of the tonsils and adenoids were the usual indications for surgery which was also simplified to an extreme by the introduction of the guillotine for clipping off the tonsils. As expressed by Wright, 'for that form of enlargement in which the tonsils project inwards, or inwards and downwards, nothing is so efficient, simple, or easy as removal with the guillotine'.[52] So easy, apparently, that the guillotine was often used without the child being anaesthetized, to be followed by removal of the nasal adenoids by a finger passed back into the pharynx. The invention of the guillotine, and the stoicism displayed by many Victorian children, may have encouraged the proliferation of this type of surgery. Probably many cases were operated upon that would be treated conservatively today, but it is difficult to compare the pre-antibiotic era with modern times.

[50] Joseph Bell, 'Five Years' Surgery in the Royal Hospital for Sick Children', *Edinburgh Hospital Reports*, **1** (1893): 466–74.

[51] *Sixty-Ninth Annual Report of the Manchester Children's Hospital* (Manchester, 1898), pp. 40–1.

[52] Ashby and Wright, *Diseases of Children*, p. 75.

To sum up, by the turn of the century surgery had a considerably expanded role in paediatric hospitals. Although accident cases, including burns and scalds, and children requiring acute abdominal surgery, continued in the main to be treated in the general hospitals, complicated surgery could now be performed in the larger children's hospitals. At Great Ormond Street and at Pendlebury the number of surgeons on the staff equalled the number of physicians; indeed it was even greater if one includes specialists, such as the ophthalmic, aural and dental surgeons, now attached to these hospitals. Nearly all the paediatric hospitals were admitting a far larger proportion of surgical cases than had been true at their inception. At Birmingham, for example, out of 214 children admitted in 1862 only 45, or 21 per cent, were surgical. However, in 1872 surgical cases represented 31 per cent of the intake, and in 1882 the proportion had risen to 47 per cent It regressed to around 30 per cent during the next decade but in 1895 was back up to 48 per cent and in 1897 surgical cases represented more than half the intake for the first time in the hospital's history. The following year plans were made, and a special collection set up, to build a new operating theatre which was completed in 1900.[53] At the East London Hospital for Children a new operating theatre was also opened in 1900. Here the number of medical cases had decreased from 1,079 in 1897, to 936 in 1898, and to 810 in 1899, while surgical cases had increased from 454 in 1897, to 520 in 1898, and to 560 in 1899.[54] The children's hospital at Edinburgh did not open a surgical ward until 1887 but, when the move was made to new quarters in Sciennes Road in 1895, a second surgical ward was provided, to be followed by a third one in 1899 and also a new operating theatre.[55] To keep their institutions up to date, and to attract the services of outstanding surgeons, management committees had to provide modern facilities which, at the turn of the century, also included equipment for taking and developing X-rays.

The discovery of X-rays by Wilhelm Roentgen in 1895 found immediate application in both surgery and medicine but particularly in orthopaedics. The fourth edition of Henry Ashby and G. A. Wright's *Diseases of Children*, published in 1899, contained 14 skiagrams (photographs of X-ray plates) illustrating orthopaedic problems. The same year a leader in the *British Medical Journal* was warning its readers that the 'new light' might be the source of litigation when patients discovered less than perfect results following the treatment of fractures.[56] By 1899 the Evelina had acquired an X-ray machine which was cared for by a visiting radiographer from the London Hospital but business was so brisk that in 1903 the Evelina appointed a radiographer, A. D. Reid, to its own medical staff.[57] An 'electrical department' was created at the East London Hospital for Children in 1902 following the gift of Roentgen ray apparatus by one of the surgeons, H. Betham Robinson. The medical staff of the hospital thought that the X-ray apparatus would mainly be used

[53] *Thirty-Ninth Report of the Birmingham and Midland Free Hospital for Sick Children* (Birmingham, 1900), p. 10. A survey of inpatients since the foundation of the hospital, indicating the number of surgical cases, was provided on p. 21 and also in previous annual reports.

[54] *Report of the East London Hospital for Children* (London, 1899), p. 19.

[55] Douglas Guthrie, *The Royal Edinburgh Hospital for Sick Children 1860–1960* (Edinburgh: E. & S. Livingstone, 1960), p. 20; G. H. Melville Dunlop, 'Diseases of Children', *Edinburgh Medical Journal*, **7** (1905): 74–80.

[56] 'The Roengten Rays in Surgical Work', *British Medical Journal*, **ii** (1899): 1026–7.

[57] Greater London Record Office, H9/EV/A2/4/1–2, Minutes of Committee of Management, 26 April, 1899; H. E. Priestley, *The Evelina* (London, 1969), p. 33.

for detection of disease in the lungs and other organs, for disease and injuries of bones and joints, and for the isolation of foreign bodies. In addition the department would provide light treatment for skin diseases and the electrical examination of nerve and muscle dysfunction.[58] The same year the medical staff at Great Ormond Street petitioned their committee of management to provide X-ray apparatus for the hospital.[59] Within a few years such equipment had become essential for any hospital caring for the acutely ill or injured.

[58] Queen Elizabeth Hospital for Children Archives, Minutes of Medical Committee, East London Hospital for Children, 10 March, 1902. The East London Hospital for Children became the Princess Elizabeth of York Hospital in 1932, and was amalgamated with the Queen's Hospital for Children 10 years later to form the Queen Elizabeth Hospital for Children. The Shadwell branch of the conjoint hospital, i.e. the former East London Hospital for Children, was closed in 1963.

[59] G.O.S. Archives, Minutes of Medical Committee, 5 February, 1902.