

Management of the bladder in traumatic injuries of the spinal cord during the First World War and its implications for the current practice of urology

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Historical review of the management of the bladder in patients with spinal injuries. Spinal injury patients – literature review – personal experience at Stoke Mandeville Hospital. Review of the different methods of catheterisation from the 19th century to today. Methods learned from the management of the bladder of spinal injuries patients were adopted into mainstream urology.

KEYWORDS

spinal injuries, bladder management, catheterisation

What's known on the subject? and What does the study add?

Prior to the First World War, traumatic injuries to the spinal cord rapidly led to death from severe infections of the bladder. During the Second World War, Ludwig Guttman resurrected the use of intermittent catheterisation at Stoke Mandeville Hospital, by meticulous attention to detail and was so successful, that this method was introduced into general urological practice.

INTRODUCTION

By the turn of the 19th century, the chief cause of death in acute and chronic paraplegia was recognized as renal failure attributable to UTIs caused by inappropriate treatment. This problem was addressed in the UK during the First World War. Although the problem was not solved, the lessons learned served as the beginning of successful management of the bladder which reached its fruition after the Second World War. The present review seeks to show how the lessons were learned, adapted and have been so valuable as to be adopted into the mainstream of general urology.

BEFORE THE FIRST WORLD WAR

IN THE UK

To gain insight into how the bladder was managed in the past, five series of patients with paraplegia by Curling, Gull, Thorburn,

Fagge and Hulke have been analysed (Table 1; [1–5]). The patients in these series were described by the physicians and surgeons responsible for their overall care but the patients only visited the hospital on an occasional basis and their day-to-day care there was the responsibility of the house surgeon who changed every 6 months. There was no specialization, no segregation of cases, and few patients were admitted. It took Hulke [5] 24 years to accumulate data on 33 patients, 22 of whom were under his own care. The descriptions are mainly of the clinical manifestations of the transections of the cord at different levels. All gave detailed descriptions of the post-mortem findings. The patients had suppurative disease of the kidneys with sloughing bladders full of purulent urine, and the majority had pressure sores. The natural history of the condition of these patients was a retention of urine with dribbling incontinence with periodic relief when the catheter was passed. There is little detailed description of the management of this but treatment consisted of cupping, blistering, mercury, leeches and purgatives.

The bladder was neglected, possibly because of the lack of specialization; urology had not yet developed as a discipline. Urology was not considered important enough to be discussed, but with careful analysis of the papers one can find descriptions that enable one to obtain a view of what was being done to the bladder. Some patients had intermittent catheterization, others had an indwelling catheter or the bladder was expressed, and some were left to be incontinent into their bed (Figs 6 and 7). Although the management of the bladder was clearly considered to be of little importance, Bell [6] and Hulke [5] both recognized its importance in the pathogenesis of renal failure and both commented on the dangers of catheterization. Hulke commented on how badly the catheter was managed by the resident staff and also on how badly the notes were kept because the resident doctors only stayed for a few months at a time. Brodie [7], when discussing tuberculosis of the spine, stated that when paralysis ensued it was a calamity, thus taking a fatalistic approach to the management of paralysis. The small number of cases under the care of individual

TABLE 1 Management of the paraplegic bladder in the UK in Victorian times

Name	Number of cases	Cause of death and description	Management of the bladder
Curling TB (1833) [1] Surgeon	Not given	Disease of the bladder	He recorded the use of an indwelling catheter in one patient and his bladder was drained four times a day
Gull W (1858) [2] Physician	40 cases with multiple causes	He describes a mixed series of cases with many dying of suppurative disease of the kidneys. 30 post mortems	Descriptions are incomplete, urine was dribbling away or passed without the patient knowing it or the bladder was expressed. In several cases a catheter was passed.
Thorburn W (1889) [3] Surgeon	50 altogether, not all traumatic	Described suppurative disease of the kidney	In five cases, he described how the urine was drained by intermittent catheterization
Fagge CH (1891) [4] Physician	36 cases of traumatic paraplegia out of 244 post mortems.	Post mortem findings indicated cystitis and suppurative nephritis	No description of the bladder management
Hulke JW (1892) [5] Surgeon	In 24 years he gathered 33 cases, 22 under his own care	In a small number of cases he describes death due to suppurative disease of the kidney	Unaware of urine being passed and in case no. 15 he describes how they used intermittent catheterization

surgeons did not enable experience to be accumulated in the UK.

ON THE CONTINENT

Two surgeons, Kocher (1841–1917) and Wagner (1848–1900) paid meticulous attention to the management of the bladder in patients with spinal injuries. Kocher [8], a Nobel Prize winner from Switzerland, described in detail how the bladder should be drained by an indwelling catheter and this catheter should be managed meticulously under a seal. In contrast, Wagner [9] who congregated a large number of patients with spinal injuries in his unit in Königshutte, Upper Silesia, described how the bladder should be managed by intermittent catheterization. This unit closed down at the end of the 19th century but it is fascinating that Guttman worked as an orderly at this hospital at the end of the First World War. Both Kocher and Wagner worked full time, taking the continental approach to the care of patients and accepting that the management of the bladder was a medical responsibility, which is in contrast to the approach in the UK where analysis of the notes shows that the information was hardly recorded and the bladder was not considered the responsibility of the attending doctor.

WARFARE: MILITARY TRIUMPHS AND MEDICAL DISASTERS

There were no survivors of paraplegia from the Crimean War [5] and in the Boer War there

was a 75% death rate for patients with spinal injuries [10].

The First World War was a conflict of unprecedented proportions. A total of 5 704 000 men served in the British Army. The British and Commonwealth Empire suffered a million deaths and two million battlefield wounded were admitted to British hospitals. In previous conflicts, casualties had been treated in field hospitals near the battlefields but the plan at the outbreak of the First World War was that the casualties should be collected rapidly from the battlefields, taken to clearing stations and then transported speedily back to base hospitals and then to the UK where definitive treatment could take place (Fig. 5). The unprecedented number of casualties from an individual offensive swamped these facilities. Many casualties died on the battlefields of Europe from exposure. The survivors were extracted with difficulty, having survived on the battlefield for many days. Thereafter, they were transferred slowly, as there was no prioritization, back to a series of receiving hospitals. Cushing [11] describes how he saw rows of injured soldiers lying by the side at the railway station waiting for transport. When the first casualties arrived in the UK, they were not expected and there was no transport for them at Victoria station. When Morris, the Chairman of the London Hospital, heard of this he contacted Lord Salmon who was a member of the house committee of the London Hospital and also the Chairman of Lyons & Co. Ltd. Within half an hour, 14 Lyons vans were transporting the patients to the

hospital [12]. There was no space for them there and beds had to be vacated. All the patients in the hospital were then transferred onto Bethnal Green hospital. Head, who was looking after the spinal patients at the London Hospital, protested and kept his spinal patients in the London Hospital. Eventually, the soldiers were transferred to numerous hospitals throughout London, the Empire Hospital, The George V Hospital, and the Star and Garter, which was the only establishment to provide long-term care [13].

Two lessons were immediately apparent from this experience: firstly, the clearing stations had to be expanded to 1000 beds to receive the huge number of casualties so that definitive treatment could take place and secondly, specialized facilities had to be developed near the front line. Special hospitals were therefore set up in France and in the UK, for:

- abdominal surgery in specialized units at the front;
- plastic surgery in base hospitals in the UK (Sidcup, Kent);
- orthopaedic surgery in a series of hospitals set up by Robert Jones throughout the UK;
- amputees (Queen Mary's Hospital, Roehampton);
- psychiatric care (Craiglockhart, Edinburgh);
- the blind;
- nervous diseases where patients were segregated in different hospitals throughout the UK, notably the National Hospital for Nervous Diseases and The Empire Hospital, which looked after paraplegics in London.

TABLE 2 Doctors managing the spinal patients in the First World War

Name	Qualification and rank
Webb-Johnson AE	General surgeon and Lieutenant colonel
Symonds CJ	General surgeon at Guy's hospital
Vellacott PN	General surgeon and major
Forbes F	General surgeon and Lieutenant colonel
Thomson Walker JW	Urologist and surgeon at Kings College Hospital. He did not go to the front but worked at the base hospital and was surgeon to the Star and Garter. He was the only urologist.

Patients with paraplegia were treated in specialized units in France. This was the beginning of specialization, with these patients being gathered at Boulogne where, Holmes [14], Vellacott and Webb Johnson [15] and Fraser [16] attended them.

The regular Royal Army Medical Core doctors were thought to be so important that they were needed to administer the large number of casualties and were not involved in the hands-on treatment of the patients. Medical care was given by general practitioners and young doctors from the hospitals, who initially volunteered for service but after 1917 were conscripted. Senior staff were recruited on a temporary honorary basis and served for a few weeks or months as consultants if stationed in the UK, while simultaneously looking after their private practice in the evenings. There was one trained neurologist, Gordon Holmes, and a neurosurgeon, Harvey Cushing. Thomson-Walker was the only urologist, although at the outbreak of the war he was still described as a general surgeon and he remained in the UK (Table 2).

The figures for paraplegic casualties are an underestimate as it is acknowledged that figures for the wounded are notoriously inaccurate owing to the transfer of patients. During the first 4 months of 1914, there were 58 paraplegics from a force of 190 000 but no doubt many more died on the battlefields or could not be retrieved to be admitted to the casualty clearing stations [18]. A total of 3531 paraplegics were discharged from treatment between 1919 and 1929.

As a result of the assembly and segregation of large numbers of patients with spinal injuries, problems became apparent and had to be addressed and lessons had to be learned. The major cause of death was renal infection, either immediately from acute ascending

suppurative infection or from the long-term consequences of pyelonephritis. The management of the bladder was now at the forefront of doctors' minds and was being addressed, although they had no background on or previous experience of how to treat a patients' bladder.

The bladder required continuous careful monitoring by expertly trained doctors. This was impossible under wartime conditions as, once the patient survived, they were transported at varying speeds from the battlefields to the receiving hospitals and as the chain is only as strong as the weakest link, so it was with the management of the bladder; it would only require one mal-administered catheterization to introduce infection or traumatize the urethra or one episode of blockage of the catheter to cause a flare up with ascending infection to the kidney. It was safer to drain the bladder continuously by means of an indwelling catheter. This inevitably led to free communication between the bladder and the outside world and infection would supervene within 24 h. A pressure sore of the urethra leading to a fistula of the penis-scrotal angle would result. For this reason, Vellacott recommended nonintervention or gentle expression of the bladder. This produced the best results but there was hydronephrosis and, in one case, a ruptured bladder. Guttmann [20] reports that when Vellacott's methods were repeated years later by Golding in the West Indies and by Cook and Smith in the Wakefield unit in the UK, they had to be abandoned. Recommendations were made that early suprapubic cystotomies should be carried out. Forbes Fraser, who was working in France, was endeavouring to instigate this but not all soldiers were receiving this treatment and Thomson-Walker commented that '*the stream of paraplegics dying from catheter infection continued unabated*' [17].

By the end of the war, the principles of treatment were well understood: the patient should be transferred rapidly to a specialized centre and doctors should devote themselves to their care full time. Unfortunately, when the war ended, the lessons were forgotten and all the specialized units, psychiatry, orthopaedics, burns, nervous diseases, plastic surgery, abdominal surgery and units for amputees, were closed down.

The exception was the Star and Garter, where initially the staff was imbued with enthusiasm and the patients underwent rehabilitation, physiotherapy and occupational therapy and were discharged home but eventually, the Star and Garter reverted to a purely custodial institution. The management there was a disaster; this was acknowledged by Thomson-Walker, a surgeon at the Star and Garter, who stated '*The management of the bladder in these cases was one of the surgical failures of the war*' and he reported complications described in Victorian times as suppurative pyelonephritis with a high death rate [19].

The reported figures for deaths of paraplegic patients in the First World War are shown in Table 3 [10,14,15,19] and a summary of the treatment methods used during this time is shown in Table 4 [20].

BETWEEN THE WARS

Between the First and the Second World Wars, the management of the bladder in paraplegic patients was a source of controversy. At a symposium on the management of spinal injuries held in 1927 at the Royal Society of Medicine, Stebbing [21], described 32 patients at the Mile End Hospital between 1919 and 1927, 14 of whom were suffering from paraplegia. Despite being managed with antiseptics and intermittent catheterization, five out of 14 patients with gross injury of the spinal cord died prematurely of pyelonephritis. In 1936 Jefferson described how patients were managed with an indwelling catheter without detriment to their condition [22]. Thomson-Walker criticized Jefferson's management of the patients, saying that these patients developed suppurative infection of the renal tract [19].

THE SECOND WORLD WAR

At the outbreak of the Second World War, large numbers of casualties were anticipated.

TABLE 3 Deaths of paraplegic patients in the First World War

Deaths at the front	Holmes (1915) [14] and Thomson-Walker (1917) [17] described that soldiers were dying at the front as they could not be retrieved
Deaths at the receiving hospitals in France	Vellacott and Webb-Johnson (1919) [15] recorded 66 paraplegic patients, 21 died, 8 from renal failure
Deaths at specialized hospitals in the UK	Symonds (1917) [10] recorded a 65% death rate and Vellacott and Webb-Johnson (1919) [15] attributed 19% of deaths to renal failure
Deaths at the long-term custodial hospitals in the UK	Of 339 paraplegic patients admitted to the King George Hospital, 160 died of a UTI. At the Star and Garter, 19 out of 111 cases died of a UTI [19].

TABLE 4 Bladder treatment options in the First World War

Methodology	Results
Intermittent catheterization	Inappropriately and inexpertly carried out resulting in infection and trauma to the urethral tract and overdistension. Tried by Golding in the West Indies and Cook and Smith, at the Wakefield unit, UK, but failure led to hydro-nephrosis and infection
Nonintervention	Led to retention with overflow
Indwelling catheter	Complications with fistula and severe infections
Manual expression	Led to the best results but required expert monitoring by experienced doctors
Suprapubic cystotomy	Avoided trauma to the urethra but attempts to enforce this were not systematically carried out. Recommended by Thomson-Walker

It was calculated that 353 000 beds would be required so that 24 225 doctors could look after the anticipated air raid casualties and Emergency Medical Service Hospitals were built [13].

It was recognized that there were going to be a large number of paraplegic patients but there was little information to guide doctors on how to care for them. Papers were produced by Douglas McAlpine and Geoffrey Knight [13] to instruct the uninitiated in the practical care of patients suffering from spinal injuries. Taylor [23] recommended an indwelling catheter, and McAlpine recommended intermittent catheterization. Riches [24] in 1944 discussed the management of the bladder but considered intermittent catheterization to be a disastrous form of treatment, reporting that all 26 patients managed by intermittent catheterization developed severe infection of the bladder and either the patients died as a consequence or the infection was still present 2 years after the injury. He recommended suprapubic cystotomy. A directive was issued, no doubt following Riches and Thomson-Walker's recommendation, that a suprapubic catheter should be used to manage the bladder [25].

Peripheral and spinal injuries were special cases and, in 1939, Riddoch was appointed consultant neurologist to the army with

the rank of brigadier. More significantly, he was chairman of the Medical Research Council committee on peripheral nerve injuries with responsibility for setting up spinal injury units. He, like Jefferson, remembered his experience of the First World War and how badly spinal injuries had been managed, and was determined that provision should be made for servicemen with spinal injuries.

Four units were designated to receive acute casualties: Agnes Hunt and Robert Jones Hospital, Oswestry; Royal National Orthopaedic Hospital, Stanmore; EMS Hospital Winwick, Warrington; and Bangour Hospital, Edinburgh.

Gradually, 12 spinal units were set up in various parts of the country to care for over 700 casualties with spinal cord injuries. The care in the chronic units was fragmented. Patients were admitted late in a debilitated state, despite directives, and up to half of all spinal injury patients never reached a spinal facility and were cared for at home or in various hospitals around the country. All the spinal units were originally due to open in 1940 but the South of England spinal unit, originally planned to be at the Wingfield Morris Hospital at Oxford, was not opened until 1944 because of administrative wrangles with the director Sir Hubert Seddon. Seddon refused to release orthopaedic beds for a

spinal unit, which resulted in a change of location to Stoke Mandeville. This may have been serendipity because lessons could be learned in this new unit and the mistakes made in the early spinal units could be avoided and certainly not repeated [13].

The treatment in all the units apart from Stoke Mandeville was appalling. Dick, in his MD thesis [26], described his experience as a medical officer of the neurosurgical ward at Winwick during the war, which was under the direction of Jefferson (who favoured indwelling catheters). The patients were managed using a suprapubic catheter, as at Bangour, whilst Stoke Mandeville doctors used indwelling catheters. Dick described the appalling treatment at Winwick, where no single doctor was dedicated to the work, saying that after 3 years, the patients were no better than when they had first arrived. At a more senior level, Riches was invited to inspect the spinal units which he described as being quite appalling. [27]

It was only when Stoke Mandeville Hospital was set up that spinal injury patients were treated and not left to die. This was acknowledged in several contemporaneous accounts, including one by McAlpine who said it was the only unit where appropriate work was being carried out [13].

FIG. 1. Aerial view of Stoke Mandeville General Hospital with the National Spinal Injuries Centre. This is a standard EMS hutted hospital. (Stoke Mandeville Hospital postcard)



FIG. 2. Intermittent catheterization was carried out on the patient's bed. The trailing curtain makes asepsis questionable. Despite these limitations, magnificent work was done which pioneered the modern treatment of spinal injuries.



STOKE MANDEVILLE HOSPITAL

The development of the treatment at Stoke Mandeville can be attributed to one man, Ludwig Guttman, a refugee in 1939 from Nazi Germany. He was appointed to manage the National Spinal Injuries Centre single-handedly. Significantly, he was the only person with first-hand experience of rehabilitation. He had been trained by Foerster in Breslau. Foerster was a medical scientist who wanted to understand what made the patients ill and how he could make them better. His chief, Wernicker said of him 'he makes the lame walk and the blind see' [28]. Guttman learned the principles of rehabilitation after peripheral nerve injuries from Foerster and put them into practice at Stoke Mandeville from the outset.¹ In 1947, he

¹Guttman gave a detailed presentation on rehabilitation after peripheral nerve injury. At a symposium on neurological rehabilitation, it is fascinating that there is no mention at all of spinal rehabilitation.

FIG. 3. Photographs of the Spinal Unit at Stoke Mandeville Hospital showing the lack of space and privacy. Patients ate their meals in the middle of the ward. There was no storage space.



FIG. 4. Guttman at his happiest, teaching in the Physiotherapy Department at Stoke Mandeville Hospital.



gave a presentation on rehabilitation after a spinal injury at the Royal Society of Medicine. He had experience in managing the bladder, carrying out the catheterizations himself. Most of the cases (148 out of 210) arrived at the centre with a suprapubic cystostomy already performed. 'We were therefore no longer in a position to decide whether any other method could have been suitably applied, for instance in incomplete lesions' [29].

Every case showed signs of UTI and, in a considerable number of the cases, the UTI was severe and included pyrexial attacks, epididymo-orchitis and stone formation in bladder, urethra and kidneys, leading to pyo- and hydronephrosis. However, where possible, he instigated and instituted intermittent catheterization.

Munro and Holdsworth had shown that the only solution to the problem was to admit spinal patients to a specialized unit immediately after injury before complications occurred. Holdsworth, an orthopaedic

FIG. 5. Postcard showing King George greeting wounded officers at a field hospital 1920's. Reproduced with permission from the Wellcome library.



surgeon, was in charge of the acute orthopaedic unit at Sheffield Infirmary and by 1955 was receiving acute injuries. He then transferred patients at a later stage to the spinal unit at Wharncliffe [13].

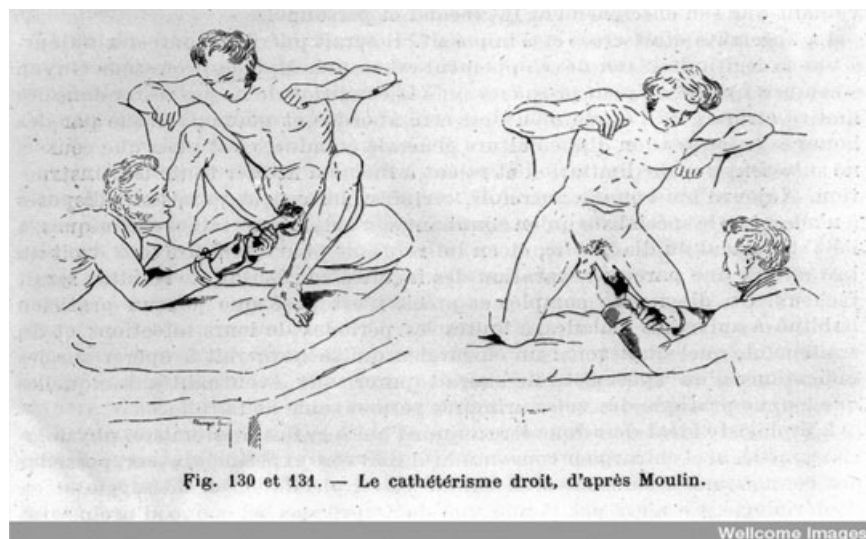
Guttman accepted the value of admitting patients early and preached this so that patients were admitted as soon after injury as possible to the National Spinal Injury Centre and if possible they should not be catheterized. Once they were admitted to Stoke Mandeville, intermittent catheterization by medical staff with a full aseptic technique was instigated as the method of choice (Figs 1, 2, 3 and 4). Guttman said, 'The sooner the paraplegic can be admitted to a spinal unit or hospital equipped with all necessary facilities, the greater his chance for speedy and complete rehabilitation' [30] but he admitted that 'The majority of paraplegics were admitted at later dates, following onset of paraplegia.' [30].

The ill effects of late admission resulting in early mismanagement can be seen by the figures by Tribe and Silver [31], in a series of 220 post mortems of paraplegic patients carried out at Stoke Mandeville between 1945 and 1965 (reflecting the treatment in the early days when late admission was the rule): there were 97 deaths in chronic patients where the primary cause of death was renal failure attributable to a combination of pyelonephritis, amyloidosis and hypertension.

INTERMITTENT CATHETERIZATION

Guttman initiated intermittent catheterization even at a late stage after injury. At Stoke Mandeville, patients were admitted as soon as possible after their injury,

FIG. 6. Catheterization, Paris 1914. Reproduced with permission from the Wellcome library.



preferably without having been catheterized and the catheterization was treated as a surgical procedure with a full aseptic technique. Intermittent catheterization was instituted 12–24 h before the development of voluntary or reflex function of the bladder. Initially gentle manual pressure was instituted and the bladder had become distended. Intermittent catheterization, as opposed to an indwelling catheter, did not permit the infection to occur and it allowed the urethral mucosa to become accustomed gradually to a foreign body. In an incomplete lesion, it would encourage the physiological stimulus for micturition, namely some bladder distension. Guttman showed that the urine could be kept sterile for many weeks by this technique.

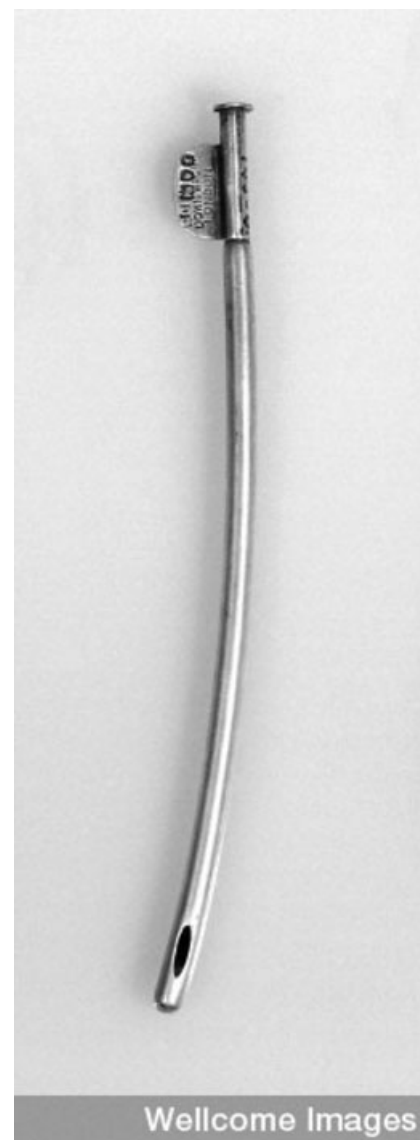
His results showed that over a period of 6 years, of 313 patients, 39% were admitted with sterile urine after an initial treatment with intermittent catheterization, and on discharge 61% were sterile and catheter-free [20].

He repeated his experience in 1966 on 476 patients (409 males, 67 females); on discharge 80% of patients had sterile urine. The effect on complications was dramatic: 35 (7.4%) developed hydronephrosis; 21 (4.4%) developed ureteric reflux; 12 (2.5%) developed diverticulosis or trabeculation; 80 (16.8%) developed minor bladder irregularity; 8 (1.7%) developed renal stones; 3 (0.6%) developed bladder stones. There was not a single case of peno-scrotal pathology.

Guttman was a determined visionary with a crusading personality. He imbued his staff with his enthusiasm and dedication to carry out these catheterizations of the patients; this took several hours a day by means of a catheter round. I was a willing disciple for 3 years, carrying out the catheterizations. He spread the doctrine around the world and resurrected, against the opposition of the established urologists, a discredited form of treatment. It was rapidly accepted in the spinal units in the UK in Sheffield, Oswestry, Southport, and in the Duke of Cornwall Hospital in Ireland, as well as in Germany, France, Switzerland, Spain, South Africa, USA, Australia and Argentina [20].

The results of this programme were so successful and easily replicated. The major practical drawback was that the technique, as developed at Stoke Mandeville Hospital, required a doctor and a catheter team and catheterization under full aseptic conditions, the team being gowned and gloved. This was not easily achievable throughout the world, particularly in the USA where the cost of labour was at a premium. However, because of the success, modification took place and the doctor was replaced by a trained catheter team of technicians or nurses [34]. The development of the concept of sterilizing the bladder by the introduction of antibiotics, a combination of Kanamycin and Colistin, so that infection was dramatically reduced, meant that only one catheterization in 200 resulted in infection [32]. Self-catheterization in patients who had useful upper limbs

FIG. 7. Silver catheter. Reproduced with permission from the Wellcome library.



was developed, as was catheterization by members of the family. This had two applications: in the acute stage, the patients could self-catheterize within a week and it formed a useful form of long-term management when the patient was discharged. Furthermore, it was demonstrated that it was not necessary to have the full aseptic technique and the concept of clean intermittent catheterization was developed.

The technique of self-catheterization for the long-term rehabilitation of the paraplegic patient reduced or avoided the necessity of urinary tract surgery such as sphincterotomy, bladder enhancement or electrical

TABLE 5 Modifications of intermittent catheterization

Date	Doctor	Country	Unit	Modification
1969	Dollfus and Molé [20]	France		Does not need to be done by doctors
1972	Comarr [35]	USA		Could be modified for self-catheterization
1974	Silver [36]	UK		Carried out dip plates on every catheterization
1976	Pearman [32]	Australia		Antibiotics instilled into the bladder, one infection in every 200
1990	Lindan <i>et al.</i> [34]	USA		Use of a catheter team
1993	Yadav <i>et al.</i> [38]	India	Chandigartha	Showed the catheterization could be done by a relative
1995	Wyndaele <i>et al.</i> [37]	Belgium	Unit rehabilitation Ghent	Could be modified for long-term catheterization of chronic patients
1996	Pickard and Grundy [39]			Does not need to be a fully aseptic technique
2010	Masri (pers. comm.)	UK	Oswestry	Still carrying out intermittent catheterization

TABLE 6 Intermittent catheterization for other medical conditions

Date	Doctor	Unit/country	Application/condition
1972	Lapides <i>et al.</i> [33]	US	Multiple sclerosis, spina bífida, urethral syndrome. Self-catheterization
1990	Lindan <i>et al.</i> [34]	US	General urology, catheter team
2000	Wyndaele <i>et al.</i> [40]	Belgium	Neurological disease

stimulation. To achieve this, further modifications were necessary since reflex contractions when they occur make self-catheterization impossible and this was achieved by enhancing the bladder storage capacity by suppressing the reflex contractions using anticholinergic drugs. These were initially given by mouth, but the systemic effects proved impossible for the patient to tolerate so it was necessary to administer these drugs into the bladder. This method became rapidly accepted as a satisfactory form of management of the bladder, avoiding operations. The procedure was greatly facilitated by the use of cheap disposable plastic prelubricated catheter equipment.

After the doctors showed on a large number of patients that the bladder could be successfully managed in paraplegic patients, that the introduction of a catheter into the bladder was not necessarily accompanied by a UTI and the bladder could be kept sterile, Lapides, who had been the most enthusiastic supporter of surgery of the outflow tract of the bladder, must be given the credit for introducing the technique into general urology [33]. He was confronted with a female patient suffering from multiple sclerosis with severe incontinence who declined to have a bladder augmentation procedure so he

started her on a regime of intermittent catheterization. This enabled the patient to resume a normal social life, to have sexual intercourse again and to eliminate UTIs. He therefore extended his trial to spina bífida patients. The demonstration that the technique could be successfully managed by the patient as a nonsterile procedure paved the way for its use in general urology for patients without neurological defect who were suffering from failure to store urine or from a hyperactive bladder causing incontinence. In a group of patients with failure to store and failure to empty the bladder, the bladder paradoxically has to be rendered atonic and paralysed by the use of anticholinesterase.

The present situation is that intermittent catheterization is the treatment of choice for patients with acute spinal injury. The indications vary on the individual units depending on the availability of staff, and long-term measures for managing the bladder of the patient.

Lindan *et al.* [34] showed that the observations on the spinal patients showed that the technique could be used satisfactorily long term provided it was carried out by trained people whether they be the patient, the carer or a catheter technician

in the community and showed that it could be of benefit in the management of patients in general urology.

A history of the modifications to intermittent catheterization is shown in Table 5 [20,32,34–39] and a summary of intermittent catheterization for other medical conditions is shown in Table 6 [33,34,40].

Thus the lessons of the First World War on the management of the paralysed bladder have turned full circle and now the successful management of the bladder in some general urological conditions has been rendered possible by paralysing the bladder! The benefits of this form of treatment have been realised and applied to other conditions. The concept of a catheter team to manage the patients was so successful that it was adopted by other departments within the hospitals for the management of geriatric patients, orthopaedic patients and for general rehabilitation of patients.

CONFLICT OF INTEREST

None declared.

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