BLADDER-NECK RESECTION IN THE PARAPLEGIC— REPORT ON OVER 100 CASES

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HISTORICAL CONSIDERATIONS

ALTHOUGH non-prostatic bladder-neck obstruction was first described by Guthrie as early as 1830 in a paper read before the Royal College of Surgeons, the idea persisted that primary bladder 'atonicity' was the cause of the retention in such cases (Bransford Lewis, 1933). No doubt this was due not only to ignorance of the underlying pathology but also to the dangers and limitations of early attempts at transurethral operative relief. However, even 30 years ago with this branch of surgery firmly established, surgeons were deterred by fear of incontinence from treating even gross cases of bladder-neck obstruction if disease of the central nervous system was demonstrable (Emmett, 1940).

To Emmett himself and his colleagues at the Mayo Clinic belongs the chief credit for demonstrating that this fear was largely unjustified. Their earlier observations were carried out on patients with old incomplete cord lesions who although ambulatory had a spastic gait and relied upon sticks or crutches. It was noted that the severe urgency and incontinence from which these patients suffered were often relieved for several hours after estimation of the residual urine by catheterisation. The symptoms returned, however, as soon as the same volume of urine had re-accumulated. In these cases the bladder was found to be trabeculated and although the bladder-neck occasionally appeared fairly normal it was often fixed or contracted and sometimes a 'hypertrophic bar, commissure or collar' was present. On such grounds bladder-neck resection seemed indicated and one of the first of these cases was operated upon on 23 February 1937, when a 36-year-old man with an incomplete cord lesion at the 12th thoracic segment due to an old fracture was completely relieved of his urinary symptoms by removal of three grammes of tissue from his bladder-neck (Emmett & Greene, 1963). Repeated success in this type of case led to a gradual extension of the operation to other types of cord bladder. The results were satisfactory in traumatic paraplegia and outstanding in tabes dorsalis, but not as good in other non-traumatic cases (Emmett, 1945, 1947; Emmett *et al.*, 1951). Soon favourable reports appeared from other workers in this field (Thompson *et al.*, 1947; Dees, 1948; Ross, 1951; Comarr, 1954; Bunts, 1958) and by 1957 Bors in a comprehensive and invaluable review could describe the literature on this subject as 'redundant'.

In spite of this there has been no major contribution to the subject from British centres and we have thought it worth while to record our own experience, presenting it against the background of a brief general review of the problem.

RATIONALE OF BLADDER-NECK RESECTION IN PARAPLEGIA

In disorders of the central nervous system two types of bladder dysfunction are found depending upon whether or not the mid-sacral reflex mechanisms remain intact. Either the bladder empties reflexly with defective voluntary control, or it

is paralysed and has to be emptied by abdominal straining or manual compression, a process which may be assisted by the concomitant weakness of the external urethral sphincter. The extent of the disability in either case depends upon the severity of the neurological damage and mixed forms are occasionally found in which the detrusor and the external sphincter are affected differently as regards retention of reflex activity. The feature common to the two main varieties is *inefficient bladder emptying* and it is no exaggeration to say that *this is the most important single factor affecting the long-term prognosis in paraplegia*.

In *sacral* (lower motor neurone, or nuclear) *lesions* the causes of urinary retention include:

1. Detrusor contractions are abolished or weakened, and the expulsive force provided by abdominal straining or manual compression alone is often relatively poor.
2. The absence of detrusor contractions means failure of the normal mechanism (Lapides, 1958) whereby the bladder-neck is pulled open so as to shorten and widen the posterior urethra and reduce the resistance to urinary flow.
3. In some late cases obstruction develops at the level of the membranous urethra, due to angulation or rigidity. This was first emphasised by Watkins (1936) and provided the first indication for division of the external urethral sphincter (Ross *et al.*, 1957).

In *supra-sacral* (upper motor neurone, or supra-nuclear) *lesions* the factors causing a high residual urine are not so obvious, especially when one considers the efficiency of the infant's uncontrolled bladder. The fact remains that chronic retention develops in some of these patients even in the presence of powerful detrusor contractions.

1. The absence of co-ordinating impulses from the mid-brain is generally blamed and Emmett (1945) has suggested that in the infant extrapyramidal pathways provide the link,
2. Contractions of the external urethral sphincter and pelvic floor muscles may raise the urethral resistance in spastic cases. This may affect even the bladder-neck, because striated muscle has been shown to reach this level both anatomically (Beneventi & Marshall, 1956) and clinically (Bors *et al.*, 1954).

In both types of bladder disorder but especially in sacral lesions (Jacobson, 1945) hypertonia and hypertrophy of the detrusor commonly develop, and the thick or spastic lower edge of the muscle increases still further the resistance at the bladder-neck. Inflammatory swelling and fibrosis naturally aggravate this tendency, eventually producing obstruction due to a ledge or shelf at the internal meatus. Our cystometric observations have shown a marked reduction in the incidence of hypertonia in recent years and this complication may have been due mainly to infection.

Indications. From the foregoing considerations it is not surprising that bladder-neck resection is usually considered to be the surgical treatment of choice at all stages of the inefficient paralysed (non-reflex, autonomous) bladder. In the spinal reflex bladder, on the other hand, it is employed for the later organic bladder-neck changes or as an alternative to destructive neurosurgical procedures (such as

cordectomy, rhizotomy and pudendal neurectomy) which are designed to reduce spasticity of the urethra but may also destroy sexual function.

The basic indication is a residual urine large enough to cause or threaten persistent dilatation or infection of the urinary tract, the relevant criteria having been arrived at empirically. Bors (1957) on the basis of a minimum bladder capacity of 250 ml. found acceptable a residual urine of 20 per cent. in cases with complete upper motor neurone lesions and 10 per cent. in those with lower motor neurone or incomplete upper motor neurone lesions. As Comarr (1959) has pointed out, however, such figures should be regarded only as a guide and if a patient with a higher residual urine shows no sign of infection or hydronephrosis he may be kept under observation whereas another patient may not tolerate even a small amount of residual urine.

The time factor is also of importance. It is well known that reflex bladder function may return at any time from several weeks to several years after a supra-sacral cord injury, though most commonly within the first six months. From Bors' (1957) comprehensive review it is clear that an early recovery is to be expected in patients with relatively low or incomplete lesions and that tidal drainage does not reduce the interval. Comarr (1959) has advocated employing conservative measures including 'bladder-training' and various nerve blocks for at least a year before undertaking more radical treatment and has found fewer bladder-neck resections necessary in recent years. Bunts (1958) has also advised a 12 months' delay but has reported a constant incidence of bladder-neck resection at his Centre over the years.

It is unfortunate that there is no test available whereby the effect of bladder-neck resection may be predicted in the way that destructive neurological procedures may be selected on the basis of preliminary nerve blocks. However, the operation has no undesirable side-effects and if it should fail, the success of secondary measures will not be prejudiced.

Our own experience is based upon the care of a total of 484 cases of paraplegia from all causes admitted to the Liverpool Regional Paraplegic Centre from 1947 to March 1964 (Table I). Excluding early non-uological deaths (40) and patients without bladder involvement (47) as well as females (25) whose problems are somewhat different, 372 patients remain for consideration. Our indications for

TABLE I
Incidence of Bladder-Neck Resection

	Total	Traumatic	Non-T
Total Admissions 1947-1964	484	299	185
Early deaths	40	31	9
No bladder involvements	47	12	35
Females	25	7	18
Total at risk	372	249	123
Cases having B-N.R.	108 (29%)	75	33

surgical intervention have followed broadly those outlined above and we have tried to assess the importance of residual urine according to the presence or absence of:

1. Persistent infection.
2. Dilatation of the upper urinary tracts.
3. Vesico-ureteric reflux.

Subarachnoid alcohol block and rhizotomy have never been used specifically to relieve retention of urine but only when demanded by lower limb spasticity. This has not been such a common problem in recent years presumably due to improved general management of the patient. We have sometimes shared the feeling expressed sporadically in the literature, however, that some complete upper motor neurone cases might benefit from a deliberate conversion to the lower motor neurone type with regard to both bladder control and the integrity of the upper urinary tracts. The choice between bladder-neck resection and pudendal neurectomy has been made in relation to the presence or absence of sacral reflex activity as well as to the cysto-urethrographic and cysto-urethrosopic findings. During endoscopy observation of the bladder-neck has been supplemented by careful palpation against the instrument. Abnormal thickening has been regarded as an important indication for bladder-neck resection. Finally, as our patients have become increasingly aware of the effect of various operative procedures on sexual function we have employed pudendal neurectomy less often and resorted instead to bladder-neck resection or division of the external sphincter or both.

During the period under review 108 patients have been subjected to bladder-neck resection, including a few whose operations were done elsewhere but whose records are available for assessment. In 60 of these cases the cord lesion was complete. This resection incidence of 29 per cent. is bound to be an underestimate as some of our more recent admissions have not yet been rehabilitated fully. Figures given in the literature range from 10 to 20 per cent. or more, but these are not necessarily comparable as they may include the categories mentioned above, which we have excluded as not being eligible for bladder-neck resection.

The intervals between the onset of paraplegia and bladder-neck resection in this series are summarised in Table II. It will be noted that in almost half of our

TABLE II
Intervals between onset of
Paraplegia and Bladder-neck Resection

	3-6 months	6-12 months	1-2 years	2-5 years	5-10 years	10+ years
Cases	25	25	12	17	16	13

cases the operation was carried out within 12 months and this is so much at variance with other reports referred to above that some explanation appears to be called for. In the first place the general policy of our Unit has been increasingly one of early mobilisation limited only by the presence of spinal instability in incomplete traumatic cases. As a result the average duration of in-patient stay of new cases admitted in recent years has been only four months and persistent urinary retention

has often been the main delaying factor in their discharge. Under these circumstances we have sometimes not felt justified in waiting indefinitely for return of bladder reflex contractions. Secondly we have not been sufficiently convinced of the value of 'bladder-training' (Munro, 1947; Comarr, 1959) or nerve blocks (Bors *et al.*, 1950) in improving reflex bladder efficiency to divert our limited resources in those directions. These factors have perhaps influenced us towards early operation for cases with a persistently high residual urine. It is admitted that a more conservative policy might have reduced the need for bladder-neck resection but we have rarely found that a patient who has been discharged with a border-line residual urine has undergone spontaneous improvement. On the other hand, shortening of the period of catheterisation by early operation has helped to reduce the incidence of urological complications.

In the past few years we have done notably fewer bladder-neck resections despite a marked increase in the rate of admission of new patients. This may well be due to the diminishing rate of cross-infection in the Unit, a trend which is exemplified by a reduction in the incidence of ureteric reflux from 30 per cent. to 7 per cent. in recent years. (Ross *et al.*, 1960.)

Technique. All are agreed that when carrying out a bladder-neck resection on a paraplegic it is essential to adopt a cautious approach and to be prepared to repeat the operation, if necessary, to achieve the desired result. This minimises the risk of producing incontinence in the case with a lower motor neurone lesion in which the resistance to flow in the distal urethra is subnormal. Furthermore, as Emmett (1947) has pointed out, the bladder wall in paraplegia may be thickened and indurated so that it may be cut more crisply and deeply than under normal circumstances, thus accentuating the risk of perforation and aggravating the tendency to haemorrhage.

The ultimate extent of the resection likely to be required is, however, the subject of some controversy. Emmett and Greene (1963) have stated that it is necessary to remove not only the bladder-neck in its entire circumference but also the adjacent bladder wall and all prostatic tissue down to the verumontanum. On the other hand, Bors (1957) has advocated a limited resection involving the anterior half of the bladder-neck in cases with upper motor neurone lesions which benefit temporarily from a pudendal nerve block and Comarr (1959) has claimed that a more posterior 'tenotomy' may be sufficient in the lower motor neurone patient. In most of their patients, however, these two workers have resected the posterior half of the bladder-neck (Comarr, 1954). Several authors have mentioned extending the later resections to include the proximal margins of the external sphincter in unresponsive cases (Baker *et al.*, 1950; Burns & Kittredge, 1958).

At our own Centre 83 of the 108 patients had a single bladder-neck resection, 23 had two and three had three, making a total of 138 operations. The number of multiple operations is less than in some other series (Comarr, 1954; Burns & Kittredge, 1958), a point which will be referred to later. The extent of the operation has depended upon the neurological, cysto-urethrographic and cysto-urethroscopic findings. In eight patients a transvesical approach was adopted reluctantly for technical reasons, but in the remaining 100 a 27 Charrière Thompson cold punch was used, including five of the eight patients with sizeable adenomata. An obstructing ledge or collar was deemed to be present in 56 out of the 100 non-adenomatous cases. About half our non-adenomatous resections have been posterior

and lateral and a quarter circumferential. The remaining operations have included a few anterior lip resections as well as some internal sphincterotomies performed with a Collings' diathermy knife. On several occasions we have not hesitated to continue the resection or division down through the external sphincter if this seemed indicated. Resected tissue has usually weighed between 2 and 3 grammes.

Complications. As in most other published series, there have been no post-operative deaths in our cases. Haemorrhage has often been troublesome and all cases have been transfused routinely so as to maintain a normal haemoglobin level. In eight cases clot retention occurred; in one, the use of an evacuator proved successful, but in four patients transurethral diathermy coagulation was required. In the remaining three cases temporary suprapubic cystostomy was performed. In only one case has extravasical extravasation of fluid occurred and this was treated successfully by retropubic drainage.

Results. Statistical assessment of results in this field is difficult especially if non-traumatic cases are included as in the present series, and comparison with other reports is complicated by differences in the clinical material, in the criteria of success and in the duration of follow-up. Comarr (1954) in an admirably clear review reported good early results in about 90 per cent. of traumatic cases following bladder-neck resection irrespective of the level of the lesion. Emmett *et al.* (1951) in a mixed group of cases with transverse lesions found early good results in 68 per cent. and improvement in a further 17 per cent. with a distinct advantage in favour of the incomplete cases. Later postal follow-up showed a net change of 5 per cent. for the worse. Bunts (1958) in a review of 188 paraplegics treated by bladder-neck resection recorded good or fair results in 85 per cent.

In our own series only 16 of the 108 patients undergoing bladder-neck resection had already been subjected unsuccessfully to subarachnoid alcohol block, pudendal neurectomy or division of the external sphincter showing that the bladder-neck operation has been our first choice in the great majority of cases. Our criterion of success has been a reduction in residual urine for a worthwhile period to a level deemed unlikely to cause or perpetuate dilatation and infection of the upper urinary tracts. From Table III it will be seen that bladder-neck resection alone gave satis-

TABLE III
Early Results of Bladder-neck Resection in 108 Cases

SUCCESSFUL					FAILED
B-N.R. alone		B-N.R. resection +			
Good 62 (57·5%)	Fair 11 (10%)	Sub-arach. Alcohol Block 2	Pudendal Neurectomy 5	Division External Sphincter 14	
73 (67·5%)		21 (19·5%)			
94 (87%)		14 (13%)			

factory results in 67.5 per cent. of cases. The resection may also have contributed to the successful outcome in a further 19.5 per cent following supplementary procedures such as subarachnoid alcohol block, pudendal neurectomy and division of the external sphincter. All but two of these external sphincter divisions were carried out for relief of reflex urethral spasticity as an alternative to destructive neurological procedures. Our confidence in this operation (Ross *et al.*, 1957, 1963) has led us to adopt it in some cases in preference to a second bladder-neck resection, and this factor explains the few multiple bladder-neck resections referred to above. The absence of any specially favourable trend in incomplete lesions may be due to the fact that these have usually been near-complete in our series. The failure of an additional organic obstruction, either adenomatous or fibro-muscular, to influence the results is noteworthy. A comparison of the results obtained by different operative procedures has proved interesting. An excellent response was obtained in all three cases treated by postero-bilateral division of the internal and external sphincters. As this operation can be carried out bloodlessly using Colling's diathermy knife-and-ball electrode it seems worthy of further trial. Both cases treated by division of the internal sphincter alone were failures but in these subsequent bladder-neck resection was also unsuccessful. In one case resection limited to the anterior lip proved effective. Circumferential resection has given a higher percentage (72) of successes than the postero-lateral operation (61 per cent.) but this may not be significant.

A typical result from bladder-neck resection in a case with a posterior ledge is illustrated in Figure 1. The rare anterior lip is shown in Figure 2. In this case division of the external sphincter was required in addition to resection of the proximal obstruction. Figure 3 reveals an even more complex example of the difficulties involved in the type of case under consideration. Despite a wide-open proximal urethra and abolition of sacral reflex activity the patient was unable to empty his bladder. There is no obvious alternative to division of the external sphincter if permanent drainage is to be avoided.

An analysis of the 14 failures is revealing: three had disseminated sclerosis; two had ankylosing spondylitis and two patients refused the offer of further bladder-neck surgery. Three tetraplegics were deemed unsuitable for further operations for various reasons. Three other patients had longstanding urological complications and the remaining patient continued to have hydronephrosis and infection despite bladder-neck resection, subarachnoid alcohol block and pudendal neurectomy.

In conformance with our general policy all the patients under consideration here have been followed up regularly year by year whenever possible and the urological check-up has included intravenous pyelography and estimation of the blood urea and residual urine. As might be expected in a series with such a high proportion of non-traumatic cases and including many neglected patients, from the early days there has been a high mortality from both urological and non-urological causes. The fate of those who did well initially following bladder-neck resection or bladder-neck resection supplemented by another procedure is outlined in Table IV. Of the 17 patients lost to the follow-up nine are known to have left the region, two have been uncooperative and only six remain untraced. The deaths from renal failure have occurred mainly in early neglected patients or among non-traumatic cases with progressive disease (Table V). Fifty-four patients have been followed to date, that is for periods varying from a few months to 17 years and 47

FIG. 1

Retrograde cysto-urethrography in a case of complete paraplegia (C7).

(a) Pre-operatively, showing posterior ledge at bladder-neck.

(b) After bladder-neck resection, illustrating wide-open posterior urethra.

FIG. 2

Retrograde cysto-urethrography in a case of complete paraplegia (T9).

(a) Pre-operatively, showing anterior ledge at bladder-neck.

(b) After bladder-neck resection, mainly anterior, showing a wide-open prostatic urethra but persistent narrowing at the level of the external sphincter.

FIG. 3

Cysto-urethrography in a case of complete paraplegia (C7).

(a) Pre-operatively, showing complete closure of the posterior urethra (retrograde injection).

(b) After sub-arachnoid alcohol block, showing moderate relaxation of the whole posterior urethra, with a ledge at the bladder-neck, posteriorly (retrograde injection).

(c) After postero-lateral bladder-neck resection, showing wide-open prostatic urethra and narrow membranous region (voiding).

(d) After resection of the external sphincter postero-bilaterally, showing exceptionally free voiding.

TABLE IV
Follow-up of 94 Cases
responding to Bladder-neck Resection

Cases responding to B-N.R. .	94
Failed F-U	17
Total F-U.	77 (82%)
Deaths	23
Follow-up to date	54

TABLE V
Deaths in 94 Cases responding
to Bladder-neck Resection

Paraplegic deaths	
Renal failure	15
Thrombosis I.V.C.	1
Non-paraplegic deaths . . .	7
Total	23

of those have continued in good urological condition. Seven patients have shown deterioration in the form of an increase in residual urine with back pressure changes or infection and two of these have refused further operative measures. In the other five (Table VI) the adverse changes have been reversed by various operations; in one by repeated bladder-neck resection after three years; in one by pudendal neurectomy after four years and division of the external sphincter after another nine years; and in three by division of the external sphincter after 3, 13 and 16 years. In all four patients subjected later to division of the external sphincter sacral reflex activity was absent. This circumstance has been referred to above under 'Rationale'. The long intervals between the original bladder-neck resection and the later procedure in the above mentioned cases emphasise the necessity stressed by Damanski and Gibbon (1956) of regular follow-up of all paraplegics for the rest of their lives.

TABLE VI
Results in 54 Patients responding to Bladder-neck
Resection and followed up to date

Unsatisfactory (refused further operation)	2
Satisfactory (without further operation).	47
Satisfactory (after further operation)	
After 4 years, P.N., + 13 years, D.E.S.	1
After 4 years, P.N., + 3 years, D.E.S.	1
After 4 years, P.N., + 13 years, D.E.S.	1
After 4 years, P.N., + 16 years, D.E.S.	1
After 4 years, P.N., + 3 years, Rep. B-N.R.	5
Total	54

SUMMARY

1. The history of bladder-neck resection in paraplegia is outlined and the rationale of the operation is considered.

2. Indications and technique are reviewed, and the practice in the Liverpool Centre is illustrated by reference to 108 patients selected for bladder-neck resection out of the 484 cases of paraplegia from all causes admitted between the opening of the Centre in 1947 and March 1964.

3. The relative high incidence of bladder-neck resection (approximately 30 per cent. of the 372 male paraplegics at risk) and the relatively early resort to operation (nearly 50 per cent. within the first 12 months) at this Centre are noted. These features are attributed to the requirements of the rapid programme of physical rehabilitation established in recent years. (The average duration of stay of all new cases admitted in the past few years is four months.)

4. In our Centre repeated bladder-neck resection has not been so common as elsewhere, probably because of the confidence felt in division of the external sphincter as a supplementary procedure.

5. Complications have been few, and mainly associated with haemorrhage. There has been no operative mortality.

6. The early results of bladder-neck resection, supplemented occasionally by other procedures, have been satisfactory in 94 out of the 108 patients.

7. The long-term follow-up has shown that, excluding patients with progressive neurological disease and neglected cases with irreversible renal damage at the time of operation, the benefits of bladder-neck resection have been well maintained.

8. The necessity in a minority of patients for further operations to deal with recurrence of residual urine after many years emphasises the importance of a regular follow-up system.

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RÉSUMÉ

1. L'historique de la résection du col vésical dans la paraplégie est présentée et la raison d'être de l'intervention est envisagée.

2. Les indications et les techniques sont passées en revue, et l'expérience de Centre de Liverpool est illustrée par l'étude de 108 patients sélectionnés en vue d'une résection du col vésical parmi 484 cas de paraplégies de toutes étiologies admis pendant une période allant de l'ouverture du Centre en 1947, au mois de mars 1964.

3. La proportion relativement élevée dans ce Centre de résections du col vésical (approximativement 30% des 372 hommes paraplégiques) et la date relativement précoce de l'intervention (presque 50% dans les premiers douze mois) est notée. Ces faits sont attribués aux exigences du programme de rééducation physique accéléré qui a été établi ces dernières années. (La durée moyenne de séjour de tous les nouveaux cas, admis dans les dernières années, est de quatre mois.)

4. Dans notre Centre les résections répétées du col vésical n'ont pas été aussi fréquentes qu'ailleurs, probablement à cause de la confiance que nous avons dans la résection du sphincter externe, comme procédé complémentaire.

5. Les complications sont peu nombreuses et souvent associées à une hémorragie. Il n'y a pas de mortalité opératoire.

6. Les résultats immédiats de la résection du col vésical complétée éventuellement par d'autres procédés a donné satisfaction chez 94 des 108 patients.

7. L'étude à long terme a montré que—excepté les patients atteints d'affections neurologiques évolutives et les cas négligés avec atteinte rénale irréversible au moment de l'opération les bénéfices de la résection du col vésical s'étaient bien maintenus.

8. La nécessité d'interventions ultérieures, chez une minorité de patients, pour combattre la récurrence d'un résidu d'urines après de nombreuses années démontre l'importance de bilans réguliers.

ZUSAMMENFASSUNG

1. Die Entwicklung der Blasenhalresektion bei Paraplegikern wird beschrieben und die Grundlagen für ihren Erfolg werden erörtert.

2. Indikationen und technische Einzelheiten werden besprochen. Die Erfahrungen des Zentrums in Liverpool, wo zwischen 1947 und 1964 108 unter 484 Paraplegikern verschiedener Ätiologie zur Blasenhalresektion kamen, dienen als Grundlage.

3. Die Operation wurde verhältnismässig oft gemacht (bei etwa 30% der 372 männlichen Paraplegiker) und verhältnismässig früh (etwa 50% der Operationen wurden innerhalb des ersten Jahres vorgenommen). Dies ist auf die Anforderungen des beschleunigten Rehabilitationsprogrammes zurückzuführen. (Die Durchschnittsdauer des Krankenhausaufenthalts aller neuen Fälle in den letzten Jahren beträgt nur 4 Monate.)

4. In unserem Zentrum war wiederholte Resektion seltener notwendig als in anderen Zentren, wahrscheinlich weil wir uns auf die zusätzliche Spaltung des äusseren Sphinkters verlassen konnten.

5. Es gab wenige Komplikationen, hauptsächlich Blutungen, und keinen Todesfall, der auf die Operation zurückzuführen wäre.

6. Frühe Resultate der Blasenhalresektion, gelegentlich von zusätzlichen Operationen begleitet, waren bei 94 unter 108 zufriedenstellend.

7. Langfristig beobachtete Resultate zeigen, dass der Erfolg der Blasenhalresektion ein Dauerresultat ist, abgesehen von Fällen von fortschreitender neurologischer Erkrankung oder von vernachlässigten Fällen mit irreversiblen Nierenschaden zur Zeit der Operation.

8. Die Tatsache, dass in der Minderheit der Patienten weitere Operationen zur Beseitigung eines Residualurins notwendig wurden, betont die Bedeutung systematischer regulärer Nachuntersuchungen.

REFERENCES

- BAKER, W. J., CARNEY, J. F. & DEROSA, F. P. (1950). *J. Urol.* **63**, 309.
 BENEVENTI, F. A. & MARSHALL, V. F. (1956). *J. Urol.* **75**, 273.
 BORS, E. (1957). *Urol. Surv.* **7**, 177.
 BORS, E., COMARR, A. E. & MOULTON, S. (1950). *J. Urol.* **63**, 654.
 BORS, E., COMARR, A. E. & REINGOLD, I. (1954). *J. Urol.* **72**, 191.
 BRANSFORD LEWIS (1933). *History of Urology*, vol. 2, pp. 137. Baltimore: Williams & Wilkins.
 BUMPUS, H. C., Jnr. (1947). *J. Urol.* **57**, 300.
 BUNTS, R. C. (1958). *J. Urol.* **79**, 733.
 BURNS, E. & KITTREDGE, W. E. (1958). *J. Urol.* **79**, 751.
 COMARR, A. E. (1954). *J. Urol.* **72**, 849.
 COMARR, A. E. (1959). *Brit. J. Urol.* **31**, 1.
 DAMANSKI, M. & GIBBON, N. (1956). *Brit. J. Urol.* **28**, 24.
 DEES, J. E. (1948). *J. Urol.* **60**, 907.
 EMMETT, J. L. (1940). *J. Urol.* **43**, 692.
 EMMETT, J. L. (1945). *J. Urol.* **53**, 545.
 EMMETT, J. L. (1947). *J. Urol.* **57**, 29.
 EMMETT, J. L., ALBERS, D. D. & ANDERSON, R. E. (1951). *J. Urol.* **65**, 36.
 EMMETT, J. L. & GREENE, LAURENCE F. (1963). In *Urology*, vol. 2, chap. 31, ed. Campbell, M. F. Philadelphia & London: Saunders.
 JACOBSON, C. E., Jnr. (1945). *J. Urol.* **53**, 670.
 LAPIDES, J. (1958). *J. Urol.* **80**, 341.

- MUNRO, D. (1947) *New Engl. J. Med.* **236**, 223.
 ROSS, J. C. (1951) *Brit. med. J.* **1**, 616.
 ROSS, J. C., DAMANSKI, M. & GIBBON, N. (1957). *Trans. Amer. Ass. gen.-urin. Surg.* **49**, 193.
 ROSS, J. C., DAMANSKI, M. & GIBBON, N. (1960). *Brit. J. Surg.* **47**, 636.
 ROSS, J. C., DAMANSKI, M. & GIBBON, N. (1963). *J. Urol.* **89**, 692.
 THOMPSON, G. J., NOURSE, M. H. & BUMPUS, H. C., Jnr. (1947). *J. Urol.* **57**, 1085.
 WATKINS, R. H. (1936). *Brit. J. Surg.* **23**, 734.

Discussion

HARDY, A. G. (*England*) was disturbed by Mr. Gibbon's remark that 'he was sometimes pressed for an early intervention by a neurologist'. He himself was a neurologist and he would not do this. He tended to be very conservative in this respect. The speed of the convoy was the speed of the slowest ship, and if the bladder were the backmarker in the programme of physical rehabilitation they must not bow to the desire to discharge people as fast as possible and in order to do so treat the bladder by a method which might not be suitable later on. He thought they ought to accept the fact that if treatment were delayed in order to achieve a better method they must not start pressing for anything.

JOCHEIM, K. A. (*Germany*) asked how many patients developed incontinence after the operation. This was especially important for females.

GIBBON, N. (*England*), in answer to Dr. Hardy's comment, said that of course if bladder-neck resection were shown to do the patient any harm one should certainly never be influenced by the time factor. Bladder-neck resection produced no irreversible harmful changes in the patient; in fact, there was considerable evidence that many of their patients whom they had perhaps discharged with a borderline residual urine were no better when they returned to hospital months later, and they had often wished they had done the bladder-neck resection earlier. It was not like an irreversible destructive neurosurgical procedure which one might perhaps regret later. If it did not do the patient any good it would not have done him any harm probably. Secondly, the incontinence could not, of course, be dismissed in a few minutes like this, but the incontinence of these patients was at least to some extent due to the residual urine: when one eliminated this one eliminated that element in the incontinence.

GUTTMANN, L. (*England*) said that, with regard to early transurethral resection as a routine to speed up efficient bladder emptying in the early stages of paraplegia, he agreed entirely with Dr. Hardy. Under no circumstances should one allow such an operation for the purpose of speeding up discharge of a patient, say two months earlier. This principle applies to any surgical procedure. The argument, which is also used by surgeons who propagate immediate or early laminectomy or open reduction, that the operation does not do any harm is not an argument which people should accept as an indication for operation, whether they be physicians or surgeons.

He was also interested in the case of unsuccessful alcohol block treated successfully by bladder-neck resection. He could quote several cases which showed just the contrary—namely, where resection of the bladder-neck had been done by his urological colleagues once, twice, three and four times, and yet the situation was still unsatisfactory, while one alcohol block produced definite results in facilitating micturition.

ROSS, J. C. (*England*) wished to mention two points. With regard to incontinence, they need have no worry at all about incontinence after resection of the

bladder-neck, as this did not occur; it did not even occur when the external sphincter was divided. Incontinence was a very complex process involving a lot of other factors as well as the sphincters; it involved, as Mr. Gibbon had pointed out, the length of the tube itself, the elasticity of the bladder-neck, the structure of the bladder-neck, the actual shape of the lumen of the urethra, all these factors came in and one did not get incontinence even after division of the external sphincter. The other point was that perhaps Mr. Gibbon had perhaps been taken up wrongly over the question of doing early resections for speeding up the recovery of the patient; he really thought the main purpose in doing these early resections was to eliminate the indwelling catheter. He thought everyone would agree that the sooner this could be dispensed with the better for the patient, and he thought this was what early resection did achieve.

HARDY, A. G. (*England*), commenting upon this terminology, said he did not know how they could say that they could eliminate incontinence when the patient was already incontinent. That was a very difficult expression. They were operating upon people who were incontinent, so it was a matter of making them more or less incontinent. Incontinence was a relative expression and this should be recorded.

WALSH, J. J. (*England*) wished firstly to endorse what Mr. Gibbon had said about doing small resections repeatedly and also what Mr. Cosbie Ross had said about discontinuing the indwelling catheter as early as possible. In this respect, he thought they had carried that to its ultimate and at Stoke Mandeville they did not have it at all. They had had to do resections on patients who had not had an indwelling catheter, and one might well have to do these operations early. He thought that in an ordinary, straightforward transverse lesion or even in a low lesion if one could not establish micturition at the end of 12 weeks one would be justified in trying to relieve mechanical obstruction by doing a resection. Another point, which he thought Mr. Gibbon had touched upon, was the question of post-operative haemorrhages; at one time he used to spend long periods dealing with clot retention, and he had learned from experience that even an extra quarter of an hour spent in haemostasis at the operation was very well worth while to achieve complete or almost complete haemostasis.

SILVER, J. (*England*) remarked that Mr. Gibbon had said early on in his discussion that he would discuss bladder training, and he did not seem to be very convinced of its value in his later discussion. He wondered if Mr. Gibbon could elaborate on this.

GIBBON, N. (*England*) said he was reluctant to get drawn into this because one could not deal with it adequately in a few minutes. He knew of no evidence which would convince him that so-called bladder training really trained the bladder at all. He thought one might train the patient to fit in with his bladder, which was a different matter altogether. He had hunted for these patients with trained bladders all over the world and had not seen one yet.

POOL, G. M. (*Holland*) thought that bladder-neck resection was done for spasticity of the external sphincter and Dr. Rossier had told them two years ago that he could achieve relaxation of the bladder by inserting procaine or xylocaine, and he wondered if it were possible to predict the result of the operation if procaine or xylocaine were given beforehand; if one obtained relaxation he thought the bladder-neck resection was justified—otherwise perhaps it was not.

GIBBON, N. (*England*) said there were two points here. One was that it was unfortunate, as Dr. Emmett had pointed out in his writing, that there was no test

beforehand which would enable one to say definitely whether bladder-neck resection would relieve a patient's retention. With regard to pudendal neurectomy, rhizotomy and alcohol block, one could give a preliminary test in the form of a short-acting local anaesthetic, either nerve block or into the theca, and say whether it was likely that the permanent destructive operation would achieve the desired result. There was unfortunately no reliable test as far as the bladder-neck was concerned. Any injection would, of course, increase the resistance at the neck of the bladder by local swelling and he did not think that anyone had found this very satisfactory. With regard to the reason for resection of the external sphincter, originally they had done this operation in precisely those patients who had no spasticity and therefore were not amenable to destructive neurosurgical procedures or blocks. Often in lower motor neurone cases there was some sort of resistance which was not spastic nor was it a stricture, but division of that region produced relief. Later, they extended the operation to cover cases who had a spastic obstruction there but in whom they did not want to do destructive neurosurgical procedures because in young cases one did not want to make them impotent. This was how the matter could rest historically.

With regard to incontinence, to answer Dr. Hardy if one had a patient with a big residual urine he might be made completely continent by eliminating his residual urine—he might have some control but be unable to manage if he had a big residual urine. In the same way, a low sacral lesion might be made completely continent by relieving his residual urine; he could empty by straining and tell when the bladder was full, and if he did not leave it too long he would not even have stress incontinence. With regard to complete upper motor neurone lesions, the patients were incontinent and could be trained to adapt themselves to their incontinence but they could not be made continent by bladder-neck resection or anything else. One could relieve their upper urinary tracts and their infection by reducing the resistance at the outlet of the bladder. Mr. Gibbons said that Mr. Ross had already corrected his initial statement regarding early resection of the bladder-neck and he now confirmed that they did these operations early because they thought they were good for the patients. They had perhaps felt a bit of pressure in the past but they were doing the right thing now on their own account and he apologised if he had maligned his neurological colleagues.

THE MANAGEMENT OF PATIENTS WITH INJURY OF THE CERVICAL SPINE USING BLACKBURN SKULL CALIPERS AND THE STRYKER TURNING FRAME

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SERIOUS injuries of the cervical spine are becoming increasingly common, mainly due to road accidents and to falls, but with expert medical, nursing and rehabilitation care, many patients with these injuries can now be salvaged and eventually returned to a useful life.

The management of patients with severe damage to the cervical spine, with or