

TREATMENT OF IDIOPATHIC HYDROCELE

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The tunica vaginalis is the smallest of the serous cavities derived from the coelom, and resembles the pleura, pericardium and peritoneum in the histological character of its lining and in that its layers are separated by a potential space containing a small quantity of clear serous fluid, varying normally between 0.5 and 2.0 c.c. An increase in the amount of this fluid is clinically known as a hydrocele.

The treatment of hydrocele dates back to the days of the Roman Empire, when Celsus attempted cure by injection of saltpetre. The great number of possible treatments described in the literature emphasizes the fact that there is no ideal cure. The various claims and counterclaims which in some instances contradict each other, tend to cloud and confuse the issue further. The three available methods of treatment are (a) tapping (b) aspiration and injection, and (c) operation.

Tapping is merely palliative except in infants, when a cure is effected.¹ Burkitt² reports a recurrence after tapping in 28 out of 30 young men and in 18 out of 20 old men.

INJECTION THERAPY

The mechanism of injected sclerosant fluid is obliteration of the tunica by a process of aseptic chemical inflammation resulting in fibrosis.

One of the earliest accounts of injection therapy is that of Samuel Sharp, surgeon to Guy's Hospital, who injected hydroceles with spirits of wine in 1733.³ This method of cure, though from all accounts effective, was exceedingly painful and was almost as formidable as the radical cures by incision, the tent or the seton, which were performed surgically at the time. Sir James Earle, senior surgeon to St. Bartholomew's Hospital in 1790, used to inject hydroceles with 'port wine, one-third part, and a decoction of red rose leaves, two-thirds parts' after withdrawing the hydrocele fluid. In 61 cases published, fairly good results were obtained.⁴

Maingot,⁵ employing injections of quinine-urethane and tuta-caine in 17 cases, had a recurrence in 3 instances. Livermore⁶ aspirated the fluid *via* a large trocar and after this evacuation of the fluid a narrow shoe-string tape saturated with sodium morrhuate solution was packed in loosely and $\frac{1}{4}$ -1 inch was removed on subsequent days. No results of follow-up were given.

Ewell *et al.*⁷ injecting quinine and urethane, report a recurrence rate of 4.3% in a series of 165 cases. On an average, 3 injections at weekly intervals were required. One patient received 17 injections. It is disturbing to read that one patient was operated on a month after 'cure' by these injections, suggesting a rather premature assessment. James⁸ using the same material claims success in 74 cases. Mayers⁹ cites one failure in 25 instances, the average follow-up period being 17.3 months. Robertson,¹⁰ using sodium morrhuate, obtained a cure in 7 patients with large hydroceles.

Diamond¹¹ claims the cure of 76 cases with a single twin injection of lithocaine and quinine-urethane. He admits no failures but does not mention the length of observation.

Foote¹² describes 95% success with quinine and urethane. Wilson¹³ in a series of 15 cases found a recurrence in 1 patient.

Unlike many previous authors he states the length of the follow-up period. It was between 8 and 20 months—perhaps a rather short time for very accurate assessment.

Rhind¹⁴ initially used 'ethamolin', but as this resulted in severe pain followed by collapse, abandoned its use in favour of quinine-urethane. Reviewing 128 cases out of 145 treated, 82 were regarded as satisfactory, 26 as improved and 20 as failures. It is edifying to note that he defined these categories accurately, but no time of follow-up is given.

A history-summary by Baretz¹⁵ mentions other preparations used in the past, which include iodine, phenol, iodine and phenol, Morestin's fluid (equal parts phenol, glycerine and alcohol), Mellenah's vaccine, equal parts of 40% alcohol and water, alcohol and phenol, milk, and 25% sodium-chloride solution.

Bruns,¹⁶ in the largest number of published series collected, cites a recurrence rate of 6.1% in 1,593 cases.

There are definite *contra-indications* to injection therapy, including: (1) Organic disease of testicles, (2) acute hydrocele associated with trauma or epididymo-orchitis, (3) the congenital variety of hydrocele, (4) infants, and (5) the presence of inguinal hernia.

Many untoward effects following the use of sclerosing agents have been recorded. Severe pain, unfavourable reactions and sloughing characterized the use of the earlier agents.

Levi¹⁷ stresses the fact that hydroceles in infancy have very thin walls, and the *vas deferens* is very closely applied to the outside of the hydrocele. If an irritant is injected to produce a mild aseptic inflammation it is not unreasonable to assume that the inflammation might spread to the closely adjacent *vas deferens* and produce stenosis or stricture. Therefore he urges that bilateral hydroceles in infants should never be injected.

Riba¹⁸ describes a case of scrotal gangrene following aspiration and injection. Solley¹⁹ describes a case where the use of phenol was followed by sloughing of the scrotum and testicle, terminating fatally from irreversible renal damage. McCastor²⁰ reports 2 cases of reaction to sodium morrhuate, both patients collapsing, with cyanosis and cessation of respiration in one and severe abdominal pain in the other. Both patients recovered. O'Malley²¹ describes how Edward Gibbon died after aspiration of an exceedingly capacious hydrocele associated with an inguinal hernia. It seems that the hernia was aspirated as well. Rhind¹⁴ quotes the occurrence of severe pain in 9 instances and haemorrhage in 5 cases, one of which became infected and another required an emergency operation.

Young²² describes the presence of dense adhesions formed between the tunica vaginalis and the tunica albuginea, covering the epididymis and testicle, occasionally leading to painful contractures. On other occasions small lobulated accumulations of fluid recurred between the epididymis and testicle and tunica vaginalis, resulting in areas of marked tenderness and sometimes considerable pain. In some cases fine string-like adhesions were present between the epididymis and testicle which, as the fluid recurred, produced painful points of tension between the testicle and epididymis.

The possible sources of *recurrence* after aspiration and injections are: (1) Incomplete evacuation, the hydrocele fluid diluting the irritant, or the protein combining with the irritant so that the endothelial lining is not sufficiently irritated or chemically inflamed; (2) a loculus remaining untapped; (3) insufficient quantity of sclerosing fluid used; or (4) sclerosing fluid too irritant.

OPERATIVE THERAPY

'Haematomata are the curse of hydrocele surgery.' This apt remark by Burkitt highlights one of the main problems related to open operation.

Jaboulay,²³ in his operation as originally described, released the testicle by ligating and dividing the gubernaculum testis, and then folded the two sides of the divided sac behind the testicle and fixed them there with a few sutures, one of which included the superficial tissues of the cord. This is described in American literature as the Wyllys Andrews or Bottle operation.

Campbell,²⁴ reviewing 502 cases treated by excision of redundant sac, reports on the following complications: (a) Infection (76 cases), (b) haematocele (18 cases), (c) scrotal oedema (4 cases), (d) infected haematoma (12 cases, of which 8 required orchidectomy). The recurrence rate was 6%, though only 33 cases were followed up, and no length of follow-up was given. In the same paper Bruns is quoted as having found a 2.4% recurrence rate in a collected series of 1,216 cases.

Mooro,²⁵ using a principle similar to the old clamp and cautery operation for piles, claims good results in 170 cases, and makes the rather emphatic statement that by using his technique recurrence is impossible. He also describes 2 cases which had had a Jaboulay's operation performed, on whom he re-operated and found that the ligature had slipped, with undoing of the eversion resulting in complete reconstruction of the sac and reaccumulation of fluid.

Wolf²⁶ did not detach the gubernaculum and only dissected the anterior half or two-thirds of the sac, with partial excision of the tunica. There were no recurrences in 19 cases. No length of follow-up was given.

Young²² states that simple eversion of the sac is more frequently associated with recurrence than radical excision, but no evidence is given to substantiate this. In order to obviate damage to vessels of the sac, he describes a procedure whereby 7 separate coverings are incised, each being stripped back, carrying with them most of the blood vessels of the sac. When the 8th and final layer is reached, there are practically no vessels to ligate, and this layer is excised. A gauze wick is inserted. No follow-up was reported. This procedure is rather complicated and laborious.

Croot²⁷ suggests eversion and approximation of the sac without paying undue attention to slight oozing of blood. This is dealt with by inserting a drain and anchoring the scrotum to the abdominal wall by sutures.

Burkitt² excises the sac and in order to prevent haematomata encases the scrotum in plaster-of-Paris. This he stresses as the most important aspect of his technique, and mentions the presence in some instances of pressure sores at the edge of the plaster-of-Paris dressing as being evidence of prevention of haematomata. He followed up 98 cases for an average period of 1.8 months and the cure rate was 99.5%. This is rather a traumatic procedure, tending to ignore the mechanism of haematoma formation and, though practical in Uganda, might not have universal application. Burkitt also stresses the fact that there is no need for drainage, because haematomata are the result of a gradual ooze between the layers of loose scrotal tissue. They cannot therefore be aspirated and a drainage tube adds to the chance of sepsis without lessening the risk of haematoma. Jerome²⁸ advises the use of an elaborate encasing elastic dressing.

Solomon,²⁹ in order to minimize the amount of dissection, does not excise any part of the sac and merely sutures the cut edge to the point of junction between testis and epididymis. In 42 cases he quotes good results, though no exact figures are given, nor is the length of follow-up given.

Özilek³⁰ describes a 'window or fenestration method' which entails opening the sac and folding the cut edges on themselves and suturing them in this position so as to make a permanent window 3 cm. in diameter in the sac. This is to enable the secreted fluid from within the tunica vaginalis to pass to the outer layers and be absorbed. This operation is based on the premise that there is a deficiency in absorption from the lymphatics of the tunica. It is discussed below in more detail.

DISCUSSION

Review of the literature is thus rather confusing and the great number of different procedures reflects the fact that there is as yet no one ideal cure. In order to obtain a more

rational approach, the mechanism of fluid accumulation will now be studied.

The tunica vaginalis is of the same histological structure as the peritoneum and has the same morphology. It consists of a single layer of flattened epithelium resting upon fine connective tissue, in which run lymphatic channels. The lymphatics of testicle, epididymis and tunica vaginalis pass within the spermatic cord and enter the pre-aortic lymph nodes, retaining their initial intra-abdominal connection. The lymphatics of the outer coverings of the testicle drain to the inguinal glands. In normal man, by means of India ink studies, Rinker and Allen³¹ have demonstrated the presence of well defined lymphatic channels in the parietal layer of the tunica vaginalis.

Only man and anthropoid apes possess a tunica vaginalis which does not communicate with the peritoneal cavity. Hence experimental work on hydrocele with the common laboratory animals is impossible.

Huggins and Entz³² pointed out that there is a constant interchange of fluid within all serous-lined cavities, and any accumulation of fluid must be due to an imbalance between secretion or absorption in this interchange. They showed by estimations of quantitative absorption of phenolsulphonphthalein that the absorption from the tunica vaginalis was slower than from any of the other serous-lined cavities, and that in patients with hydrocele the absorption was far less than in patients without hydrocele. Confirming these results, Özilek³⁰ studied the time of output from the kidney of indigo carmine injected into the vaginal sac with and without hydrocele, and concludes that in the chronic idiopathic form of hydrocele there is an impairment of reabsorption, which is therefore incapable of keeping pace with normal secretion. Rinker and Allen³¹ substantiate the inadequacy of absorption as the basic mechanism of fluid accumulation in the tunica both in congenital and idiopathic hydrocele, but point out a difference between the predisposing cause in the two conditions, as follows:

Congenital hydrocele occurs when the lymphatics of the tunica vaginalis are not sufficiently developed to remove the fluid after the closing of the communication between the processus vaginalis and the peritoneal cavity. The timing of the closure of the patent processus vaginalis with the development of the lymphatics in this structure may be the deciding factor determining whether a congenital hydrocele will be present. The descent of the testicle, development of the lymphatics to a functioning state in the processus vaginalis, and closing of the communication with the peritoneal cavity, are late processes both phylogenetically and ontogenetically. Hydroceles which are present at birth may in some cases disappear spontaneously in the first year of life. This suggests that the lymphatics were not adequately developed at birth and complete their development afterwards. Expectant treatment is therefore rational, and this also explains the curative effect of tapping in infants.

In *chronic or idiopathic hydrocele* permanent damage to the lymphatics appears to have taken place. Whether the acquired hydrocele is transitory (acute) or permanent would depend on the degree of irreversible damage to the lymphatics in the tunica vaginalis. Cure of the hydrocele is effected by surgery or sclerosing solutions because the secreting membrane is removed or rendered incapable of this function.

Two other described anatomical facts are worthy of mention:

Ratliff³³ points out that as the margin between the parietal and visceral layers are approached a heavy network of blood vessels can be noted. These are obviously endangered in dissection, and the haemorrhage will necessitate multiple ligations with resulting oedema.

Burkitt noted an appreciable gap between testis and epididymis in 72% of a series of 200 cases operated on. In many instances it was noticed that a vascular fibrous bundle crossed the sac at a considerable distance from the testis. This was often divided along with smaller vessels when the sac was excised. The fact that the band always connected the two poles of the epididymis suggested that it might consist of epididymal tissue out of normal position, and this suggestion was histologically confirmed. This finding was noted in 7 of my cases. This is perhaps another factor militating against excision of the sac.

The fundamental object in the treatment of hydroceles is: (a) to remove fluid and (b) to prevent recurrence. Any operation should satisfy the following criteria:

(i) Efficacy—in results it should be equal to any other method, if not better.

(ii) Simplicity—the less complicated procedures are obviously more adaptable to general use. Conversely, difficult operations which give good results only in the hands of the few are not surgically sound.

(iii) Safety—freedom from complications.

An operation will now be described which, it is felt, tends to fulfil the above criteria. The essence of this procedure is minimal amount of dissection, eversion of the sac, and painting of the endothelial lining with a sclerosant agent.

OPERATION

The operator, standing on the right side, grasps the neck of the scrotum with his left hand and the hydrocele is thus put on the stretch (Fig. 1). There are vessels in the scrotal skin which run parallel to one another in an oblique manner. These are made prominent by putting the sac under tension, and the incision is made in the avascular area between two such vessels (Fig. 2). In the line of the skin incision, the external spermatic fascia and cremasteric fascia are incised. The internal spermatic fascia has an entirely different appearance from that of the outer two layers. It is non-elastic and usually considerably thickened, and is tensely stretched over the hydrocele sac. There is a natural plane of cleavage superficial to this layer of internal spermatic fascia.

As the sac is not excised in this operation, it being only everted, a recess for the everted sac and testicle has to be made in order to allow for its replacement. This is a very important step in the operation. The finger is insinuated in the plane of cleavage (Fig. 3), and a recess is thus created.

The fluid is then drained by inserting a trocar and canula between two haemostats. The fluid should be allowed to escape slowly so as to prevent a too sudden release of pressure and possible rupture of fine capillaries.

The sac wall is then opened, cutting diathermy being used. It is only necessary to have an incision long enough for the testicle to be protruded or herniated and the lower part of the sac everted (Fig. 4). This limits the amount of vascular tissue that has to be divided and does not require dissection up towards the external ring, to which the hydrocele sac often extends. Moreover, the chances of the eversion undoing itself spontaneously are decreased if the incision in the sac is limited to the size of the testicle.

The testicle and epididymis are now inspected for any pathological condition. Any loculi, which are often present after tapping, can be opened separately and the fluid evacuated.

In order to prevent further secretion of fluid the endothelial lining is destroyed by painting it with a sclerosing agent (Fig. 5). Under direct vision every part of the sac can be so treated, including any loculi that were present (Fig. 6), and, as direct contact

of sclerosing agent with endothelial lining is ensured, there is no danger of using too little or excessive amounts. Two agents have been used, viz. (1) 2.5% tincture of iodine, and (2) a solution containing 13.3% quinine hydrochloride and 6.7% urethane. The latter mixture was described as the ideal sclerosing fluid by Kilbourne and Murray³⁴ in their excellent study on this subject.

A careful search is made for any bleeding, which is dealt with by diathermy or fine catgut. No attempt is made to suture the everted sac. The testicle and sac are then replaced in the recess previously made (Figs. 7a and 7b), and a continuous plain or interrupted catgut suture inserted, embracing skin and cremasteric and external fascia (Fig. 8). There is thus a minimal amount of suture material buried. Fig. 9a shows the appearances before operation, Fig. 9b after operation, and Fig. 10 after 4 weeks. No drainage is inserted. The wound is sprayed with norcetanone or tinct. benz. co., and a simple suspensory bandage of cotton wool is applied.

ANALYSIS AND FOLLOW UP

Table I shows certain particulars of the cases treated by this method.

TABLE I. CASES OPERATED ON

Case	Age	Side	Duration (Years)	Previous Tapping	Remarks
1	59	Bilateral	4	1	Associated right hernia.
2	58	Left	3	1	
3	60	Right	5	1	
4	24	Right	7	1	
5	54	Left	12	—	
6	53	Left	30	1	Very large hydrocele.
7	18	Right	18	2	
8	60	Bilateral	12	1 (R)	Associated bilateral hernia.
9	57	Right	9/12	—	
10	3	Left	3	—	Encysted hydrocele of cord.
11	72	Bilateral	30	4 (R) 1 (L)	Associated bilateral hernia.
12	44	Right	15	6	
13	61	Left	13	1	
14	53	Right	18/12	3	
15	56	Left	2	—	
16	81	Left	43	2	

The ages varied from 3 years to 81 years with an average of 50.8 years. Seven cases occurred on the left side and 6 on the right, with 3 cases of bilateral hydrocele. All except 4 patients had been aspirated at least once before.

The main presenting symptom was that of a swelling. Slight discomfort occurred in half the cases and embarrassment in 2. One patient presented himself because he experienced difficulty in micturating as he could only locate his penis with difficulty; his hydrocele was so large that it reached down to his knees (case 6).

Another patient presented with a very hard mass, suddenly increasing in size after aspiration 6 weeks previously. Although this was thought to be a haematocele following aspiration, a neoplasm could not be excluded and orchidectomy was performed. Examination and microscopy showed that it was a haematocele (case 1).

A little boy was admitted with a diagnosis of irreducible inguinal hernia. On examination this proved to be an encysted hydrocele of the cord (case 10). This was the only case where an inguinal incision was used. On exposure of the sac, the spermatic cord was found to be spiraling around the thin-walled sac. Complete excision of the sac would almost certainly have endangered the contents of the cord. Eversion



Figs. 1—10

of the sac and painting of the endothelial surface proved very safe and efficient and is probably the method of choice in all cases of encysted hydroceles of the cord.

At operation 3 cases were found to be multilocular; these had all been previously aspirated. In one case the sac was bilocular; there was no previous history of aspirations. In 5 instances there was an extension of the sac up to the external ring; in most of the cases there was some degree of upward extension.

In one patient eversion of the sac proved impossible because the wall was thick and partly calcified (case 6). In another it was extremely difficult to evert (case 4) and here

too the wall was thick. When a thick wall is present it is far better not to attempt eversion, but to excise the sac. This is perhaps the only contra-indication to eversion and painting of the endothelial lining. In case 6 orchidectomy would have perhaps been the ideal.

The post-operative findings are detailed in Table II.

The length of follow-up varies from 2 months to 4 years (average 14 months).

One patient developed a very marked oedema of the scrotum and a very severe infection and discharge (case 6). This was the man who had a hydrocele the size of a football. At one stage during the post-operative period orchidectomy

TABLE II. POST-OPERATIVE COURSE

Case	Length of Follow-up	Oedema	Discharge	Sepsis	Discomfort and Pain	Haematoma	Recurrence
1	4 yrs.	29 days	—	—	slight	—	—
2	4 yrs.	25 days	—	—	—	—	—
3	14 mths.	3 days	—	—	—	—	—
4	14 mths.	18 days	slight	—	—	—	—
5	14 mths.	8 days	slight	—	—	—	—
6	14 mths.	2½ mths. v. marked	v. marked	v. marked	marked	present	—
7	12 mths.	18 days	—	—	—	—	—
8	11 mths.	21 days	—	—	—	—	—
9	11 mths.	22 days	slight	—	—	—	—
10	8 mths.	5 days	—	—	—	—	—
11	6 mths.	15 days	—	—	—	—	—
12	5 mths.	20 days	—	—	—	—	—
13	5 mths.	18 days	—	—	—	—	—
14	5 mths.	2 mths. v. marked	—	—	moderate	—	—
15	3 mths.	3 days	—	—	—	—	—
16	2 mths.	18 days	—	—	—	—	—

was considered, but the infection subsided and after 2 months in hospital he was discharged. At the last examination the size of his scrotum was only $2\frac{1}{2} \times 2 \times 1$ inches. This was a satisfactory end result, but the long stay in hospital and post-operative infection did not, in retrospect, warrant the procedure in this case. Excision of the sac or perhaps orchidectomy would have been better alternatives.

The other instance of a marked oedematous reaction was case 14, and here it was thought that there was an element of iodine sensitivity as well as the thick-walled sac. In all subsequent cases a pre-operative intradermal sensitivity test was performed.

Oedema of the scrotum and subcutaneous tissues was a constant post-operative finding. This varied in its duration from 3 days to $2\frac{1}{2}$ months (average 22 days). If cases 6 and 14 are excluded, the average duration of oedema is 16 days. This oedema does not incapacitate the patient, and represents the reaction to the chemical sclerosant used.

The 2.5% tincture of iodine was used in 11 cases. In order to ascertain whether there might be less oedema the solution containing 13.3% quinine hydrochloride and 6.7% urethane was used in 5 cases. It is too early to assess fully whether the latter mixture was followed by less reaction than the iodine, but the impression gained is that this is the case.

Of the 16 cases haematoma has resulted in only one (case 6). In 3 cases there was a slight discharge and in one case a very marked discharge (case 6). Pain and discomfort were also very severe in case 6. So far no recurrences have been noted.

Owing to the fact that the sac is not excised, in all cases the bulk of the affected testicle was greater than that of the normal side. This was not commented on by any of the patients and did not occasion any discomfort or pain.

Though the series presented is small and the follow-up

period not very long, it is felt that this simple procedure offers results which are better than or certainly comparable with those obtained by other methods.

SUMMARY

1. Methods of treatment of hydrocele by aspiration and injection of sclerosing agents, as well as by surgery, are reviewed.

2. The probable mechanisms of fluid accumulation is discussed. It is generally agreed that the fault is a defect in absorption.

3. A new procedure which entails a minimum amount of dissection, viz. eversion of the hydrocele sac and painting of the endothelial lining with a sclerosant agent, is described. The method is simple and appears to have a low morbidity and a negligible recurrence rate.

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REFERENCES

- Joly, J. S. (1939): *Brit. Med. J.*, 1, 77.
- Burkitt, D. P. (1951): *Lancet*, 2, 1341.
- Sharp, S. (1947): *A Treatise on the Operations of Surgery*, 5th ed., p. 102. London: J. and R. Thompson.
- Farle, J. (1805): *A Treatise on the Hydrocele*, 3rd ed., p. 40. London: J. Johnson.
- Maingot, R. H. (1932): *Postgrad. Med. J.*, 8, 307.
- Livermore, G. R. (1935): *J. Urol.*, 34, 446.
- Ewell, G. H., Marquardt, C. R. and Sargent, J. C. (1940): *Ibid.*, 44, 741.
- James, W. L. (1941): *Brit. Med. J.*, 2, 693.
- Mayers, M. M. (1937): *J. Urol.*, 37, 308.
- Robertson, J. P. (1941): *Amer. J. Surg.*, 53, 421.
- Diamond, J. C. (1942): *Ibid.*, 55, 121.
- Foote, R. R. (1943): *Med. Press*, 210, 76.
- Wilson, W. W. (1949): *Lancet*, 1, 1048.
- Rhind, J. A. (1951): *Brit. Med. J.*, 2, 711.
- Baretz, L. H. (1935): *Med. Tms. and Long Is. Med. J.*, 63, 1.
- Bruns, H. (1912): *Die Behandlung der Hydrocele*. Inaugural Dissertation, Berlin.
- Levi, D. (1931): *Brit. Med. J.*, 1, 973.
- Riba, L. W. (1933): *Amer. J. Surg.*, 21, 418.
- Solley, F. W. (1936): *Surg. Clin. N. Amer.*, 16, 867.
- McCastor, J. T. and McCastor, M. M. (1937): *J. Amer. Med. Assoc.*, 109, 1799.
- O'Malley, C. D. (1943): *Bull. Hist. Med.*, 13, 200.
- Young, B. H. (1940): *Surg. Gynec. Obstet.*, 70, 807.
- Jaboulay, M., quoted by Spittel, R. L. (1928): *Brit. Med. J.*, 1, 305.
- Campbell, M. F. (1927): *Surg. Gynec. Obstet.*, 45, 192.
- Moor, A. W. (1931): *Lancet*, 2, 680.
- Wolf, M. (1939): *Surg. Gynec. Obstet.*, 68, 236.
- Croft, H. J. (1944): *Lancet*, 2, 680.
- Jerome, S. (1953): *U.S. Armed Forces Med. J.*, 4, 1241.
- Solomon, A. A. (1955): *N.Y. St. J. Med.*, 55, 1885.
- Özilek, S. (1957): *J. Urol.*, 77, 282.
- Rinker, J. R. and Allen, L. (1951): *Amer. Surg.*, 17, 681.
- Huggins, C. B. and Entz, E. H. (1931): *J. Urol.*, 25, 447.
- Ratcliff, R. K. (1953): *Ibid.*, 69, 181.
- Kilbourne, N. J. and Murray, C. J. (1932): *Calif. West Med.*, 37, 1.