A C A S E
OF
INTRA-PERITONEAL RUPTURE OF THE
BLADDER;
ABDOMINAL SECTION; SUTURE OF THE BLADDER;
RECOVERY.

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C. H—, a healthy man, æt. 22, was admitted on the morning of March 1st, 1887, into Pitcairn Ward, complaining of pain in the lower part of the abdomen. He had spent the previous evening drinking in a public-house, and between the hours of eleven and twelve was leaving for the purpose of emptying his bladder which he felt to be uncomfortably full, when words arose with a companion and they went into the street "to fight it out." During the scuffle his antagonist butted him in the abdomen with his head and he fell to the ground. After a few minutes, however, he again continued the fight, notwithstanding that he was in great pain in the abdomen, and "finished" his assailant. He was then led home in a "doubled-up condition," passed the night in great agony, and was brought in a cab to the hospital about 10 o'clock on the following morning. He had been unable to pass any urine since the injury.

On admission, he was quite sober and rational and was

suffering from very little shock, indeed, he walked into the surgery with the assistance of two friends. Strangury was not present and there was only a dull pain above the pubes. On examination a fluid tumour was discovered in the lower part of the abdomen, but appeared to be too diffuse and to extend too high in the abdomen to be the bladder. The perineum was natural, and there was no history of stricture or other urinary trouble. A catheter (No. 6 silver) was found to pass easily but no urine flowed, although its point was felt to have entered the bladder by the finger in the rectum. It could not, however, be moved from side to side, the bladder appearing to be contracted around it; but on depressing the handle between the legs it was felt to free itself with a jerk, after which it moved more easily, and the point could be felt more plainly through the abdominal walls than natural. About six ounces of bloody fluid now escaped, and it was noticed that the fluid flowing through the catheter varied with the respiration. The temperature and pulse were normal, and there was no sign of peritonitis. Mr. Spencer, the house surgeon (now Assistant Surgeon to the Westminster Hospital), diagnosed an intra-peritoneal rupture of the bladder, and immediately sent for Mr. Walsham, who arrived at the hospital about 12 o'clock noon. The patient was at once taken into the operating theatre and placed under the influence of ether at 12.15 p.m., a little more than twelve hours after the injury. The skin of the abdomen having been thoroughly washed with soap and water, and afterwards well sponged with carbolic lotion (1 in 20), an exploratory incision about an inch and a half long was made in the middle line immediately above the pubes. The abdominal cavity below the reflexion of the peritoneum was then opened but no extravasated urine was discovered. The incision was next extended upwards for another inch and a half, and the peritoneum, the reflexion of which was felt to bulge, was cautiously opened by an incision about a quarter of an inch in length, when bloody fluid began to flow. On

enlarging the aperture in the peritoneum about four pints of the bloody urine and serum escaped, but the peritoneum did not appear in any way inflamed. On passing the fingers into the pelvis the point of the catheter was felt protruding through a rent in the bladder. The rent was vertical and entirely intra-peritoneal. It measured about an inch and a half, and its edges were fairly evenly divided. In the collapsed state of the bladder the rent appeared to commence immediately in front of the posterior reflexion of the peritoneum on to the lower fundus. Some little difficulty was experienced in obtaining a good view of the part in consequence of the contraction of the recti muscles, the bulging of the intestines into the wound, and the contracted state of the bladder, which lay deeply placed in the pelvis behind the pubes. To gain sufficient room the recti muscles had to be divided for about an inch transversely, but the parietal peritoneum was not included in the lateral cuts. The intestines being held aside the bladder was now hooked upwards and forwards into the wound and there retained by the fingers of an assistant whilst the rent was being sewn up. Nine Lembert's sutures of fine carbolized China silk were employed for this purpose. The sutures, which were inserted so as to ensure half an inch of the peritoneal surface of the bladder being in contact, were placed somewhat less than a quarter of an inch apart, and one suture was passed about a quarter of an inch beyond each end of the wound so as to prevent any leakage at the upper and lower angles. All the sutures were passed through the peritoneal and muscular coats only of the bladder, and were all placed *in situ* before any were tied. Previous to securing them the finger was introduced into the bladder and carried carefully along each side of the wound to make absolutely sure that none of the sutures had penetrated the mucous membrane. After the bladder had been sewn up a chromicized catgut suture was inserted between two of the silk sutures at a spot where the peritoneal surfaces did not appear to be quite satisfactorily in

contact. Eight ounces of a 1 per cent. boric acid solution were now forcibly injected into the bladder through a soft rubber catheter. The bladder became distended but there was absolutely no leakage. On removing the catheter the bladder contracted spontaneously and expelled the contained boric acid solution in a full and forcible stream through the urethra. The peritoneal cavity was then thoroughly irrigated with a 1 per cent. boric acid solution at a temperature of 98°. The irrigating can was held about five feet above the abdomen and the end of the india-rubber irrigating tube was passed freely amongst the intestines into all parts of the peritoneal cavity. The washing out was continued till the solution ran away quite clear, about two gallons of the fluid being used. Finally, the edges of the abdominal wound were brought together by China silk sutures passed through the skin and peritoneum and the superficial part of the wound was united by chromicized catgut, a carbolized, flat Gamgee's pad being placed over the intestines while the sutures were being introduced. The transverse cut in either rectus was not united by suture. The wound was freely sprinkled with iodoform and dressed with iodoform gauze and absorbent cotton wool secured by a domett bandage and strapping as after an ovariectomy. The carbolic spray was used throughout the operation, which lasted one hour and fifty-five minutes, including the time the patient was being brought under the anæsthetic and the preliminary cleansing of the skin of the abdomen. On the completion of the operation a soft rubber catheter was left in the bladder for about two hours, when it was removed and was only used on two occasions afterwards. The patient subsequently passed his urine spontaneously and continued to pass it every four hours, being reminded to do so by the nurse. There was comparatively little shock, and the pulse continued steady throughout the operation. The patient was ordered Tinctura Opii $\text{m}\times$ every two or three hours while awake and to have no nourishment of any kind. He was allowed small pieces of ice to suck.

March 2nd.—Passed a fair night, but has not quite recovered from the shock of the operation. He has passed his urine every four hours both during the day and night, four to six ounces escaping on each occasion. It is acid, turbid, not clearing on boiling, and contains clots of mucus, a distinct cloud of albumen, and a little blood. The temperature (at 1.30) is 101° , the pulse 96, soft and slightly dicrotic. The abdomen is soft, moves freely during respiration, and is not distended. He has had no nourishment of any kind. Opium stopped.

3rd.—No sign of peritonitis; abdomen soft, moving with respiration, no pain. Pulse 96, soft, of good volume. Temperature (at 3.30) 101.4° . Thirty ounces of urine have passed during the last twenty-four hours (six ounces at 12 p.m.; eight ounces at 5 a.m., ten ounces at 9 a.m., eight ounces at 2 p.m.). The urine is still red in colour, and intimately mixed with blood. This morning ordered iced milk. Has had half a pint in four hours. Ordered two pints of iced milk in twenty-four hours and steam kettle for his cough, the result of some bronchitis set up by the ether.

4th.—Much brighter. No abdominal trouble whatever. Pulse 84. Temp. 100.2° . Passes his urine freely (forty ounces during the last twenty-four hours. 5 p.m., six ounces; 9 p.m., ten ounces; 12.35 a.m., four ounces; 5 a.m., twelve ounces; 10.30 a.m., nine ounces). The urine contains less blood, but is still distinctly red. Cough very troublesome. Spray from steam kettle continued. Linctus 3j occasionally.

5th.—No abdominal trouble. Pulse 96, soft. Temp. (at 10.15 a.m.) 101.4° ; (at 1.40 p.m.) 102° . Did not sleep well on account of his cough, which causes him pain in abdomen. Tinctura Opii $\mathfrak{mxx}$ at 7.15 p.m., and again at 2 a.m. Urine thirty-nine ounces in twenty-four hours. It is lighter in colour but still smoky, and shows blood on guaiacum test; a slight cloud of albumen. Sp. gr. 1028. Takes two pints of milk in the twenty-four hours. Ordered beef-tea in addition to his milk.

6th.—At 7.45 p.m. yesterday (March 5th) the bowels were opened for the first time since the operation; a small ordinary motion passed. Slept well after one dose of *Tinctura Opii*. Passes urine every four hours. Urine contains very little blood. Temperature lower. Dressing changed for first time. Wound looking healthy. Resprinkled with iodoform, and dressed as before. To have an egg beaten up with his milk.

7th.—Doing well. Temperature averages 100°. Pulse 90. Tongue furred. Passed forty-four ounces of urine in twenty-four hours; four to eight ounces every four hours. Urine lighter in colour, and free from blood; acid; sp. gr. 1026, a distinct cloud of albumen. Has taken a pint of beef-tea, three pints of milk, and one egg. Ordered fish and soft bread. Wound dressed again. Given an enema of hot water. Small dark motion of normal consistency passed.

8th.—Excellent night, undisturbed by cough. Pulse 84. Temperature (at 8 a.m.) normal. Tongue clean. Wound again dressed. One stitch removed upper part. Slight suppuration over situation of divided recti; about one drachm of pus squeezed out. Passed forty-one ounces of urine in twenty-four hours. Urine lighter in colour; turbid; thick sediment at bottom of vessel; pus-corpuscles on microscopical examination.

9th.—Cough gone. Pulse 80. Urine slightly offensive on standing; acid; sp. gr. 1025; contains albumen and a few blood-corpuscles. Wound dressed, silk sutures all removed; deeper parts soundly healed. Some slight suppuration at seat of divided recti. Edges of wound supported by strips of strapping. Ordered two eggs and fifteen grains of chlorate of potash every four hours.

10th.—Temperature did not rise last night. Pulse 66. Passed forty-six ounces of urine in twenty-four hours. Less pus.

11th.—Passed forty-five ounces of urine in twenty-four hours. Contains less pus. No smell on standing.

14th.—Placed on meat diet.

16th.—Urine free from albumen and pus. About fifty ounces passed daily.

24th.—Allowed to get up, wearing an abdominal belt.

April 1st.—Discharged.

Remarks.—There have now been, as far as I am able to ascertain, seventeen cases in which abdominal section has been performed for rupture of the bladder. The rupture in three of these cases was extra-peritoneal; in fourteen intra-peritoneal. Of the three cases of extra-peritoneal rupture two died and one recovered. They may be dismissed with the remark that in the case of the patient who recovered the wound was not sutured, but secured to the abdominal wall; whilst in the two

fatal cases death seems attributable to shock; in one, the anterior wall of the bladder was sutured and was found sound at the post-mortem examination; in the other, no rent in the bladder having been discovered on opening the abdomen, the abdominal wound was closed, and an incision made into the membranous urethra for the purpose of drainage; but at the autopsy the anterior wall of the bladder was found to have been perforated by a fragment of a fractured pelvis.

Of the fourteen intra-peritoneal ruptures (which more especially bear upon this case) the rent in the bladder was sutured in eleven cases; and in the remaining three a drainage-tube was placed in the wound.

To dismiss first the three cases in which no sutures were employed, one recovered and two died, death being

due in one of the fatal cases to peritonitis, and in the other to suppression of urine, the result, probably, of kidney mischief brought on by long-standing stricture of the urethra.

Lastly, of the eleven cases in which the rent in the bladder was secured by suture, five recovered and six died. Of the six fatal cases, death in three was due to peritonitis; in two it was probably the result of shock, and in one of hæmorrhage from a wound in the perineum, which had been previously made for the purpose of exploring the condition of the bladder. In the three cases in which death was the result of peritonitis, in one the suture (in this case a continuous catgut) had given way, and in the other two there was a leakage at the lower part of the wound. In two of these cases, moreover, the operation was not performed till twenty-nine and forty-eight hours respectively after the injury, the sutures were passed through all the coats of the bladder, the peritoneal cavity was not completely sponged out, and a drain-tube was employed. Further, in one of them peritonitis had already set in at the time of the operation. In the two cases in which death occurred from shock, and in the case in which it was caused by hæmorrhage, the bladder was found watertight in one (Case 4) and there was no peritonitis, but it leaked at the lower angle of the wound in another (Case 9). One of these, moreover (Case 9), was complicated by a fractured pelvis. Turning to the five successful cases in which suture was employed, the operation in all was performed within twenty-seven hours of the injury; in none had peritonitis supervened. In all the sutures were passed through the muscular and peritoneal coats only, and the peritoneal cavity was thoroughly washed out. In one of them only was a drain-tube employed. In three a catheter was retained in the bladder, though in one of these it was removed two hours afterwards. In one (Case 14) the rent was partially extra-peritoneal, and the extra-peritoneal wound was left open to serve as a drain.

Although of the eleven cases in which the rent in the

bladder was sutured more than half died, the result, when the cases are critically examined, is very encouraging; and points, I think, to this being the method which, as a matter of routine, will in the future be commonly employed in uncomplicated cases. The lessons, I think, that these cases teach are:

1stly. The desirability of early resort to operative measures, as although it would appear that the urine may remain for many hours in the peritoneal cavity without necessarily setting up peritonitis, in all the successful cases the operation was undertaken within twenty-seven hours of the injury. The importance, therefore, of an early diagnosis cannot be over-rated. The points chiefly relied on for diagnosis in the present case were:—(A) The history that the bladder was full at the time of injury; (B) the non-escape of urine notwithstanding that the catheter was ascertained to be in the bladder by the finger in the rectum; (C) the subsequent escape of bloody fluid after the point of the catheter had been felt to free itself with a jerk on depressing the handle; (D) the fact that the point could be then felt through the abdominal walls more readily than under normal circumstances; and (E) the flow of bloody urine varying with the respiration. The case was so clearly one of ruptured bladder that I had no hesitation in at once opening the abdomen. But in a doubtful case I should certainly before doing so inject the bladder through a catheter with ten or twelve ounces of some antiseptic solution, and then note if the same quantity could be subsequently drawn off.

2ndly. These cases show the importance of employing a suture that will not become softened and give way, and of making sure by forcible injection of the bladder that the viscus has been rendered thoroughly watertight. In four of the unsuccessful cases the fatal result may, I think, undoubtedly be attributed to the leakage through the wound at one spot. It is therefore most necessary that attention should be paid to this point, and especially to the securing of the lower and posterior part of the

wound, as it was here in three instances that the leakage occurred. This danger of leakage may perhaps best be avoided by following the suggestion of Sir William Mac Cormac, of placing at least one suture beyond the angles of the wound.

3rdly. With regard to the cleansing of the peritoneal cavity, irrigation would appear to be preferable to sponging out; but so long as the cleansing is thoroughly done and the fluid is of a non-irritating character it does not seem to matter what fluid is used. In four cases, boric acid (1 per cent.) was employed; in one, sublimate solution; in another merely warm water.

4thly. A preliminary incision in the perineum for the purpose of exploring the bladder, or subsequently with the object of drainage, does not commend itself for adoption. The exploration in doubtful cases can be better performed through an incision above the pubes, not necessarily opening the peritoneal cavity till after the upper fundus of the bladder has been examined and found sound; whilst a subsequent incision in the perineum can only do harm by allowing septic changes to occur and spread to the bladder. In Mr. Teale's case the fatal result was due to hæmorrhage from the perineal incision.

Lastly. The tying in of a catheter after the operation appears to be quite unnecessary if the rent in the bladder is securely sutured and care is taken that the patient passes urine every four or five hours. The presence of a catheter, moreover, as in Hofmohl's case, seems attended with the risk of cystitis, and subsequently of septic changes occurring in the bladder wound. In my own case the catheter was removed after two hours; in Sir William Mac Cormac's second case and in Mr. Holmes's case it was not used at all.

A table of the seventeen cases in which abdominal section has been employed for ruptured bladder is here added. Sixteen of these appear in Sir William Mac Cormac's table appended to his interesting paper on abdominal section.

Seventeen Cases of Ruptured Bladder treated by Abdominal Section.

A. INTRA-PERITONEAL.

Case	Reference.	Surgeon.	Age.	Cause.	Date after injury.	Condition of peritoneum.	Size and condition of rent in bladder.	Kind of suture.	Treatment of peritoneum.	Incision in perineum.	Catheter in bladder.	After-treatment.	Remarks.	Death or recovery.
1	St. Barth. Hosp. Rep., 1876	Willott	48	Kick	29 hours	Peritonitis	3½ inches, oblique, superior and posterior, ragged below	8 China silk, ¼ inch apart, through all coats	Partially washed out, drain-tube	No	Yes	—	Peritonitis; lower angle of wound given way	Death.
2	Med.-Chir. Trans., vol. lxii, p. 335	Heath	47	Blow	42½ hours	Much blood present	2 inches, vertical, posterior	Continuous catgut, through all coats	Partially sponged out, drain-tube	No	Yes	—	Peritonitis; lower angle of wound given way	Death.
3	Lancet, 1886, vol. ii, p. 972	McGill	34	Contact iron gate	66 hours	Contained a pint of urine; no peritonitis	4 inches, superior and posterior	9 chromic gut; mucous membrane not included	Washed out with 2 galls. boric acid solution; peritoneum closed; incision in bladder in front of peritoneum for drain-tube; spray	No	—	—	Died 18 hours afterwards, probably of shock; no peritonitis	Death.
4	Lancet, 1887, vol. i, p. 1133	Teale	25	Kick	—	Large quantity straw-	1 inch, posterior	6 fine catgut, Lambert's	Closed; not stated if washed	Yes, for exploration	No	—	Died 7 hours after of hæmorrhage	Death.

					coloured fluid; no perito- nitis				out; no drain		Yes	Catheter removed 3rd day; not again needed	from peri- neum; no peritonitis; bladder watertight	Re- covery.
5	Lancet, 1886, vol. ii, p. 1118	Mac Cormac	33	Ran against post	19 hours	Healthy; no blood- clots	4 inches; median, vertical, posterior, superior	16 Lembert sutures, first and last beyond limit of wound; catgut between; drain-tube no leakage	Irrigated 2 galls. boric acid at 98° till fluid clear; no sponging; spray; drain-tube 4 days	No	Yes		No bad symptom	Re- covery.
6	Lancet, 1886, vol. ii, p. 1119	Mac Cormac	37	Fell in sitting pos- ture	27 hours	Large quantity of urine and serum; no peri- tonitis	2 inches, oblique, superior and posterior, left side	12 fine silk Lembert's, one above and below rent; no leakage	Irrigated, boric acid, 98°; no drain-tube	No	No	—	External wound united in a week	Re- covery.
7	Unpub- lished	Walsham	22	Blow	12 hours	4 pints blood- stained fluid; no perito- nitis	1½ inches, vertical, posterior, even	9 China silk Lembert's sutures, one above and one below rent; no leakage	Irrigated boric acid, 1 p.c., 98°, till ran clear; no drain	No	Yes, 2 hours only	No nourish- ment for 24 hours; opium every 2 hours; sutures removed	No bad symptom	Re- covery.
8	Lancet, 1887, vol. ii, p. 153	Holmes	24	Kick	6 hours	—	2 inches	8 fine silk; peritoneal and muscular coats only	No spray; washed out with warm water	Yes, me- dian; soft tube in urethra, not in bladder	No	—	Did not drain through tube	Re- covery.

Reference.	Surgeon.	Case.	Date after injury.	Condition of peritoneum.	Size and condition of rent in bladder.	Kind of suture.	Treatment of peritoneum.	Incision in perineum.	Catheter in bladder.	After-treatment.	Remarks.	Death or recovery.
9 Annals of Surgery, 1885, vol. i, p. 67	Bull	46 Fall, 16 feet	13 hours	Bloody urine	3½ inches, posterior	7 Lembert's carbolized silk; not tested for leakage	Sponged out; intestines were drawn out of wound and protected by warm moist towels	No	Yes	—	Died 7 hours after; fractured pelvis; great shock, comatose; wound leaked, lower angle	Death.
10 Lancet, 1886, vol. ii, p. 399	Duncan	38 Passage of wheel	22 hours	Bloody urine; peritonitis	2½ inches, posterior	No sutures	Washed out; glass tube in Douglas's pouch	Yes, tube brought through incision	No	Nutrient enemata; small doses of sulphate of magnesia	Died 79 hours after; suppression of urine; kidney mischief result of stricture	Death.
11 Centralblatt für Chirurgie, 1885, p. 838	Sonnenberg	— Fall	48 hours	Peritonitis	Vertex to neck, posterior	No sutures	Drain-tube, through upper part of abdominal wound	No	No	—	Died on 4th day; intense peritonitis; urinary infiltration in pelvis	Death.
12 Unpublished, McCormac's Abdominal Section, p. 54	Walters, of Pittsburg	22 —	10 hours	Bloody urine; signs of peritonitis	Extensive rent at base	No sutures	Drain-tube; clots sponged out	No	Yes	Not stated	Recovery.	
13 Unpublished, McCormac's Abdominal	Symonds	7, —	7 hours	Bloody urine	V-shaped; partly intra-	12 Lembert	Sponged out	No	No	Peritoneum reopened for irri-	Died in 7 days; bladder leaked at	Death.

Section, p. 53	Hofmokl	27	Fell from win- dow, frac- ture of pelvis	10 hours	Much bloody fluid	partly extra- 1½ centi- metres; also extra- perito- neal rent behind pubes	2 rows carbolized silk; edges pared where irregular	Sponged out with sublimate tampons; extra-peri- toneal rent only parti- ally closed to act as drain	No	Yes	gation Opium, ice over abdomen	one spot; peritonitis Cystitis; urethritis	Re- covery.
14	Unpub- lished, Mac Cormac's Abdominal Section, p. 52	Fox	38	—	19 hours	Bloody serum	2½ inches, 15 anterior wall, extra- perito- neal	Not stated	Not stated	Yes	Not stated	Died in 42 hours; bladder wound firm; great shock	Death.
16	Unpub- lished, Mac Cormac, Abdominal Section, p. 53	Mayo Robson	68	—	3 hours	Not injured	Anterior wall; frag- ment of frac- tured pelvis in rent; ex- tra-peri- toneal	Laparo- tomy; no rent found	Wound closed	No	Not stated	Died in a few hours from shock	Death.
17	Annals of Surgery, Feb., 1887	Socin and Keser	20	—	—	Not injured	Anterior wall; extra- perito- neal (?)	Laparo- tomy; bladder wound sutured to abdominal wall	Drain-tube 9 days	No	—	—	Re- covery.

B. EXTRA-PERITONEAL.

(For report of the discussion on this paper, see 'Proceedings of the Royal Medical and Chirurgical Society,' New Series, vol. ii, p. 333.)