

The result, then, is that Mr. Lister has since the end of 1871 treated conservatively in hospital 40 cases of injuries of healthy joints without a death, and in only one case (wounds of joints, No. 3), was there any necessity for further operation. This was a case of wound of joint not made by the surgeon. In only one case in which the joint was opened by Mr. Lister did suppuration occur (No. 22), and here, as I shall presently shew, the aseptic method had been imperfectly carried out.

It has been objected to these cases by Mr. Bryant,¹ that an equally good series of cases might be found in the case-books of any hospital. It may indeed be that in some instances equally good results have been obtained, but I venture to affirm that no hospital case-book, recording cases not treated aseptically, would show that *all the cases treated in succession* had like results. It is as an integral record of a number of cases in succession rather than as a record of each individual case that these facts are important. There will no doubt be found throughout the journals isolated examples of remarkable results after injuries of joints, but then only the successful cases are published; we do not have a record of *all* the cases in the practice of a particular surgeon; we do not hear of the many cases where failure occurred, or where conservative treatment was not attempted. Then, again, the cases ordinarily recorded in journals have not been treated in the same way as Mr. Lister's. For Mr. Lister not only makes an incision into a joint, but he purposely keeps the communication open for some days by means of a drainage tube, and he does not syringe out the joint with any antiseptic solution. I do not believe that such a thing could be done with a poultice or other septic dressing without the occurrence of suppuration in the joint, and yet among Mr. Lister's 26 operation cases this only happened in one instance, and in it, as I shall presently point out, we have complete evidence that the requirements of the method had not been efficiently complied with.

Mr. Bryant also expressed his astonishment that Mr. Lister should regard the removal of foreign bodies from joints as a perfectly safe procedure on the evidence of 3 cases. But then it must be remembered that every case in which a joint was

¹ MacCormac's *Antiseptic Surgery*.

incised, for whatever purpose, proves the assertion that they may be opened for the removal of foreign bodies, and so at the time when Mr. Bryant spoke the evidence rested, not on 3 published cases, but on 20 cases of operations and 12 cases of accidental wounds, i.e., not on 3 but on 32 cases. And in reality it rested on many more, for this record only represents Mr. Lister's practice since the end of 1871. For five years previously Mr. Lister had been operating on joints in hospital with success, and the details of some of these cases have been published. And in private practice, also, during all these years Mr. Lister has performed a number of operations on healthy joints. Further, during the same time, many of Mr. Lister's pupils had performed similar operations with similar successes. Thus the evidence in support of Mr. Lister's statement is sufficiently ample to justify it.

It was further stated by Mr. Bryant, that a number of these cases were too trivial to be of value, but I venture to doubt the force of this argument. For I do not suppose that an incision into a carpal articulation will be regarded as a very trivial matter, and we have in the list only 3 cases where small joints were opened. But I do not regard wounds of phalangeal joints as such a very trivial injury after all. The cases of compound dislocation of the phalanges which I have seen treated conservatively but septicly have almost all died. It may be that I have had an unlucky experience, but I have seen that amputation is in the great majority of cases performed for these injuries, and that where they are treated conservatively and without aseptic precautions a great risk is run. The only case of wound of a small joint not treated aseptically which has occurred to my knowledge at King's College Hospital during the last four years died of tetanus.

In speaking of ovariectomy I have said that it was not a test case, because the peritoneum absorbs fluid so quickly that the bacteria, if admitted, have no fluid in which they can develop; and I also added that the test case would be where there was ascites as well as an ovarian tumour, where, therefore, there was fluid in which organisms may develop. Such cases have always been regarded as particularly unfavourable for operation,

though surgeons do not as a rule seem to have understood the reason of this. A corresponding condition may be got in the case of joints, more especially in the knee joint in hydroph articuli. The ordinary practice in such cases, if they refuse to yield to the ordinary methods, is to remove the fluid by aspiration. That practice has been found to be perfectly safe; it is a subcutaneous, in fact an aseptic, operation. In Edinburgh in 2 cases of this kind (chronic synovitis), Mr. Lister made incisions into the joints and introduced a drainage tube. In neither case was there the slightest bad result. In the first case the drainage tube was removed on the fourteenth day, and the wound healed a few days later. In the second case the drainage tube was kept in a few days longer, and the wound had completely healed in five weeks. In both instances the disease was cured; in both the movements of the joint were perfect; in neither was there any suppuration, inflammation or constitutional disturbance. In King's College Hospital Mr. Lister has made incisions in 3 cases of acute synovitis verging on suppuration, and in all cases with cure without suppuration. In these cases the knee-joint was affected. In 2 the movements were good when the patient left the hospital. In the other movement is perfect, but the leg is kept in a silicate apparatus, as the ligaments have not yet regained their firmness, and the limb is apt to become over extended. (In this instance the inflammation was much more extensive, affecting the adjacent portions of the tibia and femur and producing softening of the ligaments.)

Then I must mention, that Mr. Lister's practice in cases of synovial disease of joints where the disease progresses in spite of rest, counter-irritants, &c., is to make free incisions into the joints, and introduce drainage tubes into them. This is done at once, without waiting for the formation of abscesses, in cases where the disease is progressing. In 16 cases so treated since 1871 no pus was present, and of these 16 cases 11, or 68.7 per cent., were cured without any further treatment (excision or amputation), and there never was any suppuration from the joint. In several of the cases considerable movement was obtained.

The cases were:—

INCISIONS INTO DISEASED JOINTS.

8 incisions into the knee-joint—no pus—7 cured without further operation							
4	"	"	farsus	"	2	"	"
2	"	"	elbow	"	2	"	"
2	"	"	wrist	"	0	"	"

None of the cases died.

Then, as I have said, where suppuration has occurred, the joint is also, in the first instance, simply incised and a drainage tube inserted; if necessary, further measures can be resorted to afterwards. Of 48 abscesses of joints so treated 27, or 56.3 per cent., were cured without further operation; and in these there was no more formation of pus after the incision.

These cases comprised:—

19 abscesses of the hip-joint—13 cures without further operation—1 death						
11	"	"	knee	5	"	1
6	"	"	tarsus	3	"	1
2	"	"	shoulder	1	"	—
3	"	"	elbow	1	"	—
7	"	"	wrist	4	"	—

There were three deaths, all of them from tubercular meningitis, confirmed on post-mortem examination. One other case not included here must be mentioned. A patient, a little child, was admitted into King's College Hospital with pyæmia after scarlet fever. Abscesses were present in various joints, and as they were causing him considerable pain, they were opened. The child died two days later.

Thus, taking all the cases together, we have 109 instances where joints, healthy or more or less diseased, were opened and drainage tubes inserted; and of these 109 cases only 3 died, the cause of death in each instance being quite independent of the method of treatment adopted.

Leaving Mr. Lister's practice we find records of a number of wounds of joints in the practice of other surgeons.

Volkman, in his first report, mentions the occurrence of 7 wounds of joints and 2 incisions into joints for loose cartilages without a death. In his last report he adds 24 cases of penetrating wounds of joints making in all 33 cases, distributed as follows, without a death.

	Cases	Deaths
Knee	15	0
Wrist	8	0
Elbow	5	0
Foot	5	0

No details of these cases are given, and we do not therefore know whether any further operative interference was necessary.

In his paper on compound fractures,¹ Volkmann adds the fact that 21 compound fractures passing into joints were treated without a death. With regard to these last 21 cases, we have some further particulars. In 2 instances resection was at once performed; in 5 resection was performed secondarily; in 3 amputation was performed secondarily; in 10 there was perfect recovery with freely movable joints; and in 1 case there was recovery with ankylosis, but the treatment was not commenced in this instance till thirteen days after the injury, and the joint was then already suppurating. In all these cases there was extensive injury of the bones as well as wound of the joint. In 3 cases the secondary operation was performed because the patient was not admitted for some time after the injury, and the joints were already suppurating; in one case the supervention of gangrene rendered it necessary, and in the other cases the nature of the wound, malposition of the fragments or suppuration of the joint, required it. Of course in considering cases of *wounds* of joints it must always be remembered, that one can never be certain that all the causes of putrefaction already present have been destroyed, and therefore, the probable result is very different from, *i.e.* much more uncertain than, that where the surgeon makes the wounds himself, and where, therefore, he has merely to exclude these causes. This is well illustrated in the case of compound fractures.

Max Schede, in his work on amputations, states that he has treated 15 cases of compound fracture in which joints were opened. Of these 10 were treated conservatively and healed, in 9 instances (5 of elbow, 2 of hand, and 2 of foot) with movable joints, in 1 with ankylosis, where the case was not admitted for some time, and where there was extensive com-

¹ 'Die Behandlung der complicirten Fracturen,' *Volkmann's Sammlung*, Nos. 117-118.

minution of the tibia, numerous portions of which necrosed. In 2 cases amputation was necessary on account of gangrene; in 1 case, which was not admitted till ten days after the injury, secondary amputation was performed; in 1 case of elbow injury a partial secondary resection was necessary, and in 1 case death occurred from trismus, the patient not having been admitted till the thirteenth day after the injury, when the joint was already suppurating.

Taken together with Volkmann's 54 cases we have 69 cases with 1 death. With Mr. Lister's 40 cases we have a total of 109 cases of injuries to or operations on healthy joints with 1 death, a death which ought not to be reckoned at all, for the patient was not treated aseptically from the beginning.

Both Volkmann and Schede mix up the cases in which treatment was commenced at once with those in which the patient was not admitted for some days after the injury, and where the joint was already suppurating. If we separate these cases from the 36 instances of compound fractures with wounds of joints, of which we have details, we find that 28 came under treatment within forty-eight hours after the occurrence of the accident, and of these 19 recovered with movable joints; in 2 cases primary and in 4 cases secondary resection was necessary, and in 3 secondary amputation was performed (twice for gangrene). On the other hand, of the 8 cases which did not come under treatment till forty-eight hours or more had elapsed, none recovered with movable joints, 2 recovered with stiff joints, 4 required secondary resection, 1 secondary amputation, and 1 died of tetanus. Of course in judging of the effects of the aseptic or other method of treatment in preventing the bad effects liable to follow wounds of joints, the latter class of cases, where treatment is not commenced for several days, ought to be excluded.

Paul Barth¹ published in 1877 the results of the cases of wounds of the knee-joint which had been treated in the hospital at Basel since 1873. They were 10 in number. Of these 9 recovered with movable knee-joints and one died of exhaustion. The latter was a case of compound fracture of the patella along

¹ *Ein Beitrag zur Behandlung der perforirenden Wunden des Kniegelenks*, by Paul Barth, Basel, 1877.

with injury to the right side of the head and fracture of the lower ends of both radii; the result of a fall from the first floor of a house to the street. For four days things seemed to be going on well, and then the patient began to complain of pain in the knee. The wound on the forehead began to suppurate, and the bone became bare. The patella also necrosed. An abscess formed in the thigh, and the pus had a foul smell. The patient sank, exhausted from the prolonged suppurations, about six months after the injury. In this case purification had not in all probability been successful in the first instance. Among these 10 cases we have 6 which were seen soon after the injury: the other 4 having come under treatment several days later when suppuration was commencing, or had already begun. The success in purifying the wounds in these 4 cases is remarkable; they all recovered with movable joints. In purifying them, the wound was swabbed out with chloride of zinc, and then irrigated with strong carbolic lotion, several counter-openings being also made. The successful disinfection in these cases was a piece of luck, for one can by no means reckon on anything like such a result.

Saxtorph of Copenhagen has published the results of his aseptic practice in removing foreign bodies from joints by free incision.¹ He has had 12 cases, 11 being cured and one ending fatally. In this case the patient took off the antiseptic dressing, suppuration ensued, and the patient died.

Piéchaud² has collected a number of cases of incisions into joints. He gives 4 cases of hydrarthrosis of the knee-joint which were treated by free incisions and aseptic drainage. They were operated on by Panas, Poinot, Saxtorph and Lindpaintner. In 3 of the cases there was perfect cure with free movement of the joint. In the fourth case, in a strumous subject, there was some fear that synovial disease was going to develop, and therefore the patient was discharged wearing a silicate apparatus with which he could walk about without pain.

Piéchaud mentions 3 cases of dislocation of the thumb where, in order to reduce the dislocation, free incisions were

¹ *Clinique Chirurgicale.*

² *De la ponction et de l'incision dans les maladies articulaires.* Par le Dr. T. Piéchaud, Paris, 1880.

made into the joint. All recovered with retention of the normal movements. In a fourth case, the finger, which was otherwise much injured, became inflamed, and amputation was performed on the following day. Piéchaud also states, that in the course of the year he had seen in M. Labbe's clinique at the Lariboisière several similar cases where wounds of the phalangeal joints healed by first intention when treated aseptically.

Professor Nussbaum,¹ states in his work on aseptic treatment, that 'this method opens up a new field to surgeons. By the aid of these precautions, joints and the cavities of the body may be opened without danger.' This is his experience in an unhealthy hospital.

Professor Albert² of Innsbruck says; 'Die operative Eröffnung seröser und synovialer Hohlräumen die bei offener Wundbehandlung regelmässig zur Eiterung führt, führt unter Lister nicht zur Eiterung. Man kann Hydrocelen, Gelenke, Schleimbeutel ohne Gefahr eröffnen.'

Professor Hueter of Greifswald says; 'it is with reason that I said in 1870 that puncture of joints ought to be considered as a dangerous operation; it is with as much reason that I now affirm (1876) that one can practice this operation without danger. I based my first opinion on the septic accidents consecutive to the inflammation.'

M. Létievant of Lyons also says:³ 'Des tentatives opératoires nouvelles, très-graves, devant lesquelles on pouvait hésiter, ont pu être mises en application, et si je n'avais eu la sécurité que me donnent mes statistiques et une pratique déjà longue du pansement listérien, je n'aurais jamais osé ouvrir largement des grandes articulations, les luxer pour les nettoyer, remettre les os en place, drainer et conduire la plaie à guérison.'

Kraske gives details of all the gunshot injuries of joints treated at Hallé aseptically.⁴ They were 4 in number, and, in all the cases, the knee was the joint involved. In one case the movement was perfect, healing having taken place without

¹ *Le pansement antiseptique*, 1880.

² *Lehrbuch der Chirurgie.* Wien, 1877.

³ Note sur le Pansement antiseptique Listerien. Lyon, 1880.

⁴ Langenbeck's *Archiv*, vol. xxiv.

the occurrence of suppuration. In a second it was not absolutely perfect, but it was almost right, and was improving; no suppuration. In a third the movements were good as far as a right angle, when the patient left the hospital. In the fourth case the patella was very much broken up by the bullet and portions of the bone afterwards exfoliated. The wound had quite healed in two months. When the patient was discharged about two and a half months after the accident, the patella was freely movable and the joint could be moved by the surgeon to an angle of 150°. The patient did not return to have the passive motion kept up, and when seen a year after the accident, the joint was ankylosed.

I have already alluded to the remarkable results obtained by Dr. Carl Reyher¹ during the recent Russo-Turkish war, and I must now mention in detail these results in cases where joints were injured.

Reyher divides the cases treated into 'Primary antiseptic cases,' 'Secondary antiseptic cases,' and 'Non-antiseptic cases.' By 'Primary antiseptic' cases he means those which were treated aseptically from the very first, and which had not been examined beforehand with dirty fingers or instruments, or treated in any way. In these cases Reyher either washed out the wound with an antiseptic solution, removed any foreign bodies present, drained and treated aseptically, or he did not wash out the wound at all, but simply contented himself with purifying the exterior and applying an antiseptic dressing. In the latter cases he trusted to Esmarch's idea that the bullet would not carry dust into the interior of the wound. The former practice was adopted where the wound was gaping, and where there was a suspicion that portions of clothing, &c. had been carried in with the bullet; the latter practice, where the edges of the skin were lying together, and where it was thought that the bullet had not carried any extraneous matters with it. By 'Secondary antiseptic' cases he means those which had been examined or treated in some way opposed to aseptic principles before coming into his hands. In a few cases suppuration had already commenced. He tried to purify these wounds by washing them out with carbolic lotion, but the attempt was seldom

¹ Volkmann's *Sammlung*, Nos. 142-143, 1878.

successful. They are, therefore, as I have already pointed out, cases treated with antiseptics, not aseptically. The 'Non-antiseptic cases' were treated either with dry dressing, or with some watery or oily application containing an antiseptic.

Reyher demonstrates completely that all the cases which he mentions were perfectly comparable injuries, and that the results must therefore be due to the different ways in which the patients were treated. Every case, with the exception of very severe wounds caused by shell, was treated at the beginning conservatively.

Forty-six cases were treated by 'primary antiseptics,' and of these 6, or 13 per cent., died. With regard to these 46 cases, however, primary resection was performed in 19, and of these 2 died, leaving 27 cases treated conservatively with 4 deaths, or a mortality of 14.8 per cent. The following were the joints which were injured:—

	Total	Healed	Died	Percentage mortality
Shoulder	1	1	0	0
Elbow	2	2	0	—
Hip	1	0	1	100 p. c.
Knee	18	15	3	16.6 „
Foot	5	5	0	—
Total	27	23	4	14.8 „

Eighteen of these cases were treated without washing out the wound; in 9 the wound was washed out and drained. In none of the 27 was resection or amputation necessary.

The causes of death in the 4 fatal cases were as follows:— In the injury of the hip-joint acute inflammation and septic suppuration occurred: here it was found that the bullet had carried in a portion of the clothing. One case of knee-joint injury died from fatty embolism within twenty-four hours. One knee-joint case died on the fifth day from hæmorrhage from the divided popliteal artery and vein. The fourth case had not died when the report was issued, but a fatal result was considered certain from hectic fever and diffuse suppuration; I have therefore included it among the fatal cases.

Seventy-eight cases were treated by 'secondary antiseptics,' and of these 48, or 61.5 per cent., died. Of the remaining 30 cases, only 8 ultimately retained their limbs, secondary resec-

tion being necessary in 15 cases, and secondary amputation in 7.

	Total	Lived	Died	Percentage mortality
Shoulder-joint	7	4	3	42·8 p. c.
Elbow	11	8	3	27·2 "
Hand	5	4	1	20 "
Hip	4	0	4	100 "
Knee	40	6	34	85 "
Ankle	6	4	2	33·3 "
Tarsus	5	4	1	20 "
Total	78	30	48	61·5 "

The causes of death were in 17 cases pyæmia; in 16, septic inflammations; in 4, very acute suppuration of the joint; in 9, hectic; in 1, carbolic acid poisoning; and in 1 there was jaundice.

Contrasted with these two sets of cases, there were 62 where no antiseptic precautions were taken. Of these 39, or 62·9 per cent., had died when the first report was issued, but in the Appendix we are told that 9 more had died, the mortality being thus raised to 77·4 per cent. The causes of death in the 39 cases were, in 23, from pyæmia; in 6, from septic inflammations; in 6, from hectic; and in 1 the cause was unknown.

The joints involved were (first report):—

	Total	Healed	Under treatment	Died	Percentage mortality
Shoulder	7	0	4	3	42·8 p.
Elbow	11	0	5	6	54·5 "
Wrist	6	1	3	2	33·3 "
Hip	4	0	1	3	75 "
Knee	23	1	4	18	78·2 "
Ankle	11	1	3	7	63·6 "
Total	62	3	20	39	62·9 "

The amended table a month or two later would probably be:—

	Total	Healed	Under treatment	Died	Percentage mortality
Shoulder	7	0	3	4	57·1 p. c.
Elbow	11	0	5	6	54·5 "
Wrist	6	1	3	2	33·3 "
Hip	4	0	0	4	100 "
Knee	23	1	0	22	95·6 "
Ankle	11	1	1	9	81·7 "
Total	62	3	12	47	75·8 "

One additional case died, but I do not know what joint was injured. The number of limbs treated ultimately conservatively is not mentioned.

A similar result is obtained if similar injuries are compared. Thus take the wounds of the knee-joint; and first the cases in which the bullet became embedded in the bones and in which conservative treatment was tried.

	Treated conservatively to end			Intermediate amputation		Secondary amputation			Total	Percentage mortality
	Recovered	Died	Total	Recovered	Died	Recovered	Died	Total		
Primary antiseptic	4	0	4	—	—	—	—	—	—	—
Secondary antiseptic	0	8	8	0	2	2	1	4	5	4
Non-antiseptic	0	4	4	—	—	—	0	5	5	100

These facts are surely striking enough. Out of 28 cases of wound of the knee-joint where the bullet became embedded in the bones only 5 lived, and of these four were treated aseptically and retained their limbs. One case recovered which was treated with 'secondary antiseptics,' but only after secondary amputation.

The results are equally striking if we take all the cases of wound of the knee-joint.

	Treated conservatively to the end		Secondary resection		Intermediate amputation		Secondary amputation		Total			Recovered	
	No.	Died.	No.	Died.	No.	Died.	No.	Died.	No.	Died.	Percentage mortality	Joints movable	Joints stiff
Primary antiseptic	18	3	—	—	—	—	—	—	18	3	16·6	15	—
Secondary antiseptic	19	18	—	—	9	7	12	9	40	34	85	—	1
Non-antiseptic	9	6*	1	1	—	—	13	11	23	18	78·2	—	—

* Had died at time of report.

(The last line must be amended, for ultimately only 1 of