minimum fatal dose of the given preparation. A convenient unit is obtained by dividing one by the minimum fatal dose per gramme body-weight of frog; or, in other words, the number of units will be the reciprocal of the minimum fatal dose. To illustrate: if the minimum fatal dose of a given drug per gramme body-weight of frog is found to be equivalent to 0.01, then the given substance, assuming that it belongs to the group of heart tonics, would contain 100 heart tonic units: $(\text{m.f.d.} \frac{1}{0.01} = 100 \text{ h.t.u.})$ This rule can be applied to any of the heart tonics as a means of expressing such values in whole numbers.

Instead of stating the full number of heart tonic units in all cases round numbers can be used, which do not vary more than a given per cent. from the actual number of units. Reference to tables shows what may be accomplished.

A correction will be necessary where the minimum fatal dose of the standard is more or less than that mentioned in the table of standard values already given, such correction to be made as per illustration already cited. According to the formula the minimum fatal dose of standard divided by the minimum fatal dose of unknown

$$\frac{(\text{m.f.d. of standard})}{(\text{m.f.d. of unknown})} = \text{per cent. of standard}$$
 equals the percentage value of unknown. The percentage value of the unknown can easily be converted back into the normal minimum fatal dose as shown below.

M.F.D.	Exact H.T.U.	Approximate H.T.U.	% error.
0.0001	10000	10000	0
0.0002	5000	5000	0
0.0003	3333	3330	0.9
0.0004	2500	2500	0
0.0005	2000	2000	0
0.0006	1666	1660	0.4
0.0007	1428	1430	0.1
0.0008	1250	1250	0
0.0009	1111	1110	0.1
0.0010	1000	1000	0
0.0011	909	910	0.1
0.0012	833	830	0.3
0.0013	769	770	0.1
0.0014	714	710	0.5
0.0015	666	660	0.9
0.0016	625	620	0.8
0.0017	588	590	0.3
0.0018	555	550	0.2
0.0019	526	520	1.1
0.0020	500	500	0
0.0100	100	100	0

M.F.D. = minimum fatal dose per gramme body-weight of frog.
H.T.U. = heart tonic units.

In actual practice a table can be constructed similar to the above for all the values that will be derived in the testing of the heart tonics under all conditions. These may be printed on a sheet or sheets of paper and kept for reference in a book form or placed on a chart to hang on the wall of the operation room and used in the same manner as interest or logarithm tables. Such practice would obviate entirely the necessity for the person doing the testing to make mathematical computations unless a correction would be needed, in order to convert an abnormal minimum fatal dose into a normal minimum fatal dose. These variations also can be worked out and converted into tables.

Conclusions.—1. It has been shown by numerous laboratory workers that it is impossible to determine the value of the heart tonics of the digitalis series by chemical assays. 2. It is a well-recognised fact that the toxicity of these products warrants that every effort should be made to present preparations of them of as uniform value as possible. 3. Experiments upon animals have demonstrated conclusively that the variation in the physiological action of some of these products is extremely great. 4. It is urged that this section appoint an international committee

to determine and recommend the best method of physiological assay of the heart tonics of the digitalis series and an international standard, "heart tonic unit," to express the physiological value of the pharmaceutical products of this series. 5. The author puts forth the above method of physiological assay, which is the result of nearly 15 years of laboratory study, for consideration as a possible solution of this problem.

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RUPTURE OF THE SPLEEN; REMOVAL; RECOVERY.

By T. S. LUKIS, M.B.

THE patient, a schoolboy, aged seven years, was admitted into St. Bartholomew's Hospital under the care of Mr. D'Arcy Power on May 12th, 1908, at 10.30 P.M., having been run over by a van weighing two tons. It was alleged that the wheels passed right across the boy's abdomen.

On admission the patient was collapsed; his face was pale, his lips were blue, and his body was cold and clammy. He had passed fæces and urine under him, but no blood. He was very restless, turning about, and preferring to lie on his face. His pulse was 140 and irregular, the temperature was 96° F., and the respirations were shallow, numbering 34. An examination revealed some bruising of the left side of the chest and abdomen. There was a graze on the left side of the chest over the ninth, tenth, and eleventh ribs and another graze on the abdomen just above the anterior superior iliac spine. The appearance suggested that the wheels did not pass right over the abdomen, but merely grazed the left side of it. The abdomen was tender, rigid, and resonant all over and moved very little with respiration. The child complained of pain, especially in the left lumbar region. No free fluid and nothing abnormal could be felt in the abdomen. Mr. G. E. Gask saw the case and decided not to operate, the condition of the child being unfavourable.

The patient was very restless all night. His pulse kept at 140 and was irregular. His temperature rose to 97°. He passed two ounces of urine free from blood and he vomited food twice. At 6.30 A.M. the pulse became much worse and soon could not be felt. The abdomen was much distended but the distension was partially relieved by an enema at 8 A.M. For the rest of the day until 5 P.M. the pulse could not be felt, but it then returned to 130 and the patient seemed much better, his colour improving.

On the following day Mr. D'Arcy Power decided to operate, the general condition of the child having improved greatly. At 3.30 P.M. chloroform was administered and a vertical incision was made 3½ inches long through the left rectus muscle above the umbilicus, 1½ inches from the middle line. The peritoneal cavity was opened and was found to contain a quantity of blood-clot and blood which was washed out with saline solution at a temperature of 110°. The anterior surface of the left lobe of the liver was found to be grazed over an area of about the size of a crown-piece, but had stopped bleeding. The spleen was drawn out of the wound and was found to be badly lacerated, the lower third of the organ was almost separated from the rest, and there were extensive lacerations in the region of the hilum. The organ was held in place by a mere strand of mesentery which ruptured when an attempt was made to ligature it. As bleeding had also stopped in the spleen, some of the arteries of which were very definitely thrombosed, no attempt was made to recover and ligature the pedicle. The bleeding through the peritoneal opening had never been very free during the operation, but a drainage tube was left in the wound to be an index of possible further hæmorrhage. The child came through the operation very well, and there was no further extensive hæmorrhage, the drainage tube being removed on the sixth day, when the pulse had quieted down to 100. The patient made an uneventful recovery.

The points of interest in the case are. First, that a delay in operating, amounting to 42 hours, did not prejudice the patient's chance of recovery, but probably saved his life. Mr. G. S. Simpson, in an article in THE LANCET of August 11th, 1906, mentioned that of 28 cases of ruptured spleen which he had collected three operated on within two

hours of the accident died; of 14 operated on within 24 hours of the accident 11 survived; of six operated on from 24 to 48 hours after the accident five survived; and of five operated on from two to eight days after the accident one survived. Secondly, that hæmorrhage had so far arrested itself that ligature of the pedicle was dispensed with.

There are two specimens (2308*a* and 2308*b*) in the St. Bartholomew's Hospital Museum which show how nearly the spleen can repair itself after extensive laceration. The first was taken from the body of a woman, aged 42 years, who fell a distance of 30 feet. She was admitted to the hospital in an unconscious condition and was treated for a simple fracture of the left thigh. She died in an exhausted condition ten weeks after the accident from cystitis and morbus cordis. She never complained of any abdominal injury throughout her illness. At the necropsy the spleen was found to be torn on its anterior and external surfaces. The rent passed right through the organ, involving the capsule, and was closed by a firm, white scar, one-eighth of an inch in diameter. The outermost border of the spleen was soft and lacerable, and tore when it was separated from the clot which lay above it. The subperitoneal tissue was stained a dark purple colour, evidently by an extravasation of blood which had taken place some time before death. An encapsuled collection of fluid blood was situated immediately round the spleen. The second specimen was taken from a woman who died 60 hours after being run over by an omnibus. The spleen was extensively torn on the outer surface near the upper margin, but the rupture was closed by a firmly adherent clot. This woman also had a small rupture of the right lobe of the liver.

THE TREATMENT OF CHRONIC SUPPURATION OF THE MAXILLARY ANTRUM: AN OPERATION AND NEW INSTRUMENTS.

BY JAMES DONELAN, M.Ch., M.B. R.U.I.,

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FOR several years there has been a growing tendency amongst surgeons to abandon the alveolar method of draining acute or chronic abscesses of the antrum of Highmore. Where an acute abscess is obviously connected with dental disease that method may still be adopted in the hope that the evacuation of the cavity may in a short time be followed by cure. The recorded experience, however, of most surgeons in this country and abroad appears to be that this result is but seldom attained and then only when all the conditions, especially that of the middle meatus, are favourable and when there have been very few or no previous attacks. The more common issue is that the acute condition becomes chronic and the patient has to go on syringing through the alveolus until he makes up his mind to have some further operation that will not only allow freer drainage but will permit the path of buccal re-infection to be closed.

One of the chief causes of the abandonment of the alveolar method is the recognition of the fact that maxillary suppuration is far more frequently set up by infective conditions within the nose or its other accessory sinuses than from the teeth, which are perfectly sound in a great many cases. Such antral abscesses are now usually treated in the acute stage by intranasal puncture and irrigation together with removal as far as possible of all obstruction to the natural outlet in the middle meatus. When this fails, as it must be admitted it very often does, further measures consist in the removal of a greater or less portion of the external wall of the nasal cavity so as to drain the antrum into the inferior meatus or, in very obstinate cases, the radical operation through the canine fossa with a large counter-opening into the nose.

The experience of the last 12 or 15 years shows that with the increasingly early recognition of the causes of intranasal suppuration the necessity for the radical operation arises much less frequently than was formerly supposed and that it should be reserved for cases in which other measures have failed or those complicated with well-marked polypus formation in the antrum or nasal cavity. My own experience is that if a sufficient opening is made in the exterior nasal wall and nasal polypi and part of the middle turbinal are

removed at the same time one often avoids the canine operation despite considerable degeneration of the antral mucous membrane.

For the past ten years I have given up the alveolar route except in a very few cases of acute abscess of dental origin, and none of these was cured without eventual recourse to the intranasal method. Realising that removal of part of the nasal wall of the cavity was likely to give better results than any other method I have tried instruments of various forms with a view to improving the technique, especially in the clean and rapid removal of the excised portion. Forceps were found slow and uncertain in a rapidly bleeding cavity, while breaking down the partition roughly with a burr was followed by a greater tendency to cicatricial contraction with very often formation of little pus pockets between the irregularly torn fragments of the mucous membrane. Moreover, in many cases patients complained of severe neuralgic pain for several hours after the burr was used.

With a view to overcoming these objections I designed a right and left rectangular chisel, of which the present is the third modification. When these instruments were shown lately at the Laryngological Section of the Royal Society of Medicine,¹ reference was made to some instruments designed for a similar purpose by the late regretted Dr. McKay MacDonald. That was the first time I heard of Dr. MacDonald's instruments. I have never seen them, but I was given to understand on that occasion that they were made in sets of four and were in other respects quite different from mine. The chisel (shown in Fig. 1) has a stout handle

FIG. 1.

Rectangular chisel for maxillary antrum.

and shaft with a double-edged blade wrought in the same piece at right angles. Along the "obverse" side this blade has a strong ridge slightly hollowed in the middle to facilitate retention in the cut. The "reverse" side is flat and placed at an angle of about 50° to the shaft. My first pair of chisels were made of English shear steel and gave satisfactory results without a second sharpening in 63 cases. The next were of too soft a material, had to be sharpened twice in 13 cases, and in the last of these a portion of the blade broke off in the left antrum but was recovered when the bleeding had ceased. The present instruments, by Messrs. Krohne and Sesemann, have been used in 27 cases, some of them of old persons with hard, thickened bone, and do not yet require sharpening. The resistance of the living bone of the antral wall, even more than an eighth of an inch thick, has no perceptible ill-effect on a good steel edge. Stress is laid on this point here as it has been objected to instruments of this class that they require frequent sharpening.² For the initial puncture I have designed an angular gouge V in section, with curved cutting edges brought to a point. (Fig. 2.) This has, I think, some advantages over the large

FIG. 2.

Curved gouge for antral wall (part of shaft A omitted).

curved solid trocar often used for this purpose, as it not only pierces the wall but makes a clean-edged < cut which gives the starting lines for the subsequent incisions.

The operation may be performed in some cases of young persons under local anaesthesia and suprarenal ischaemia. I have not found this method satisfactory even in persons of considerable fortitude when the bone was hard and there was

¹ Proceedings, vol. i., No. 6, p. 112.

² Ibid.