were adhesions between the duodenum, gall-bladder and the quadrate lobe, involving the common bile duct. The walls of all the abscesses were ragged and the contents necrotic. The duodenum showed inflammation and necrosis of the mucous membrane at the junction of the first and second parts. Sounding with a probe revealed a block in the lumen of the common bile duct proximal to the sphincter of Oddi. The stomach showed a partially healed ulcer ¾ inch in diameter along the lesser curvature near the pyloric end. The gall-bladder was thickened and opaque, and had an area of acute inflammation in the body. There were healed and active ulcers in the most dependent portion of the cæcum. The other viscera were congested. Under the microscope the walls of the abscesses were seen formed by compressed and elongated liver cords, the individual cells being atrophic, with inspissated bile. Sinusoidal congestion and round cell infiltration were seen. Further away from the abscesses, whose contents were necrotic with a few leucocytes and numerous amœbæ, the picture was the same, with the usual cord and lobular pattern not prominent.

Comment.—In case 1, a malignant growth of the liver and gumma were thought of, but not amœbic abscess, and likewise in case 2, secondary metastases in the liver, since the patient had an epithelioma in the cheek. It would appear that in neither case were the fæces examined because the nature of the condition was not suspected in the least. The purpose of this article is to emphasize that in tropical countries hepatomegaly with jaundice should suggest the possibility of an amœbic abscess in common with other toxic, degenerative, inflammatory and neoplastic conditions. A routine examination of fæces for the vegetative and cystic forms of *Entamœba histolytica* is of paramount importance, since coincidental hepatic and colonic lesions are common in our experience. In a series of ten complete autopsies of liver abscess we performed, associated intestinal lesions were seen in six. A diagnostic aspiration should be done unhesitatingly, since the material obtained can in any case be utilized by the pathologist for a histopathological examination, to decide upon the nature of the malignant growth, if the material is not amœbic pus.

The sub-icteric tinge seen in amœbic hepatitis is due to the impaired function of the liver cells, the cause of toxic jaundice. It will be appreciated from our case reports that deep jaundice can occur only in obstruction to the main bile ducts, but may be found in acute as well as in long-standing abscesses, the mechanism of obstruction being different in the two instances. In an acute abscess with ragged walls as in case 2, the tension in the abscess is not likely to reach the level at which pressure on the main bile ducts would be exerted and cause jaundice, since necrosis can spread further, a factor which will contribute to the size of the abscess but not to pressure. What then could produce obstruction to the bile ducts? It is the peri- and intra-ductal inflammation which produces partial or complete obstruction. On the other hand, in a long-standing abscess with a thick fibrous wall, the tension inside the abscess is bound to be high, and pressure on a main bile duct should cause jaundice of an obstructive type.

The question then arises as to why jaundice is such a rare accompaniment though tropical abscess is by no means uncommon. We feel that the occurrence of jaundice is primarily influenced by the situation of an abscess and the nature of its wall and least by its size. This would explain the absence of jaundice in abscesses which are very large but situated on the antero-superior aspect. Mere destruction of liver parenchyma, as is seen in portal cirrhosis, does not cause jaundice, as there is a great reserve of excretory power. When 95 per cent of the liver has been destroyed, the surviving 5 per cent is capable of preventing jaundice.

Summary.—Two cases of jaundice in tropical liver abscess are reported.

The pathogenesis of jaundice is discussed, and examination of fæces as a routine is recommended in every case of hepatomegaly with jaundice.

The diagnostic utility of aspiration biopsy is emphasized.

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A NEW TECHNIQUE IN STERNAL PUNCTURE

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A knowledge of the changes in the bone marrow has become indispensable in the diagnosis of various blood diseases and protozoal and bacterial infections in the tropics. In the year 1903, Wolff obtained the marrow from the medullary cavities of tibia and femur by open operations. Just about the same time, Pianesi (1903) aspirated bone marrow from the long bones after puncturing with Potain's apparatus. Ghedini (1908) was the first to trephine the upper end of the tibia and curette the marrow. For nearly two decades, this method was extensively used. Seyfarth (1923) simplified the technique by trephining the sternum instead of the tibia. However, this method of investigation was not very widely

practised, since sternal trephining involved the care of a surgical operation. Arinkin (1929) simplified the technique by puncturing the sternum with a stout needle and aspirating a mixture of blood and bone marrow. Subsequently many modified types of needles have been devised for sternal puncture (Arieff, 1931; Baserga, 1934; Weller, 1937). Salah's needle (1934) made on similar lines is in common use in this country.

The superiority of sternal trephining over puncture is accepted by all, since the marrow aspirated by the latter method is always diluted with blood. It is generally agreed that the greater the volume of fluid aspirated, the greater is the admixture with blood. By comparing trephine and puncture methods on the same case, Jeannert showed that in the aspirated fluid the more immature cells and megakaryocytes are not always included. Since aspirated material contains variable quantities of blood, enumeration of leucocytes, nucleated red cells, erythroblasts and megaloblasts, has given inconsistent results. At times, the variations are so great that the figures add nothing of value to the data. To overcome this, Henning and Korth injected heparinized plasma through the puncture needle before aspiration, and claimed withdrawal of marrow elements without a mixture of blood. However, in routine examination of smear preparations of bone marrow, the disadvantages of sternal puncture are outweighed by the ease and simplicity of the technique.

The purpose of the present communication is not to enter into a detailed comparison of the two methods and their relative merits, but to describe a new technique, introduced by the senior author, whereby the simplicity of sternal puncture is retained and the disadvantage of dilution eliminated.

The new sternal puncture needle (figure 1) employed in this technique is a steel rod (gauge 44) 2 inches long, with a deep vertical gutter in its last $\frac{3}{4}$ inch, and a bevelled tip, fixed to a thick handle. The left wall of the gutter is higher than the right, and its edge is sharp, so that when the needle is rotated clockwise while inside the medullary cavity, the marrow is scraped and the gutter filled. A section of the needle across the gutter is shown in (figure 2).

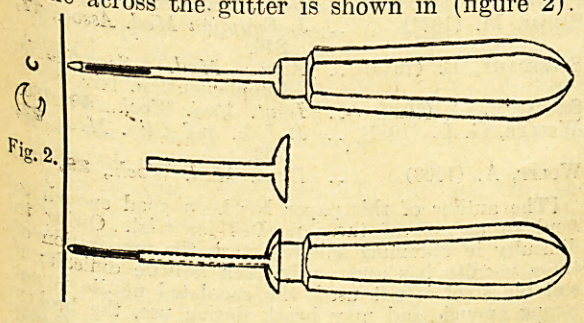

Fig. 2.

Fig. 1.

Fig. 1.—Reddy's sternal puncture needle with the shield.
Fig. 2.—Section of the needle across the gutter, lower one magnified.

A cannula or shield made of thin steel encloses the needle up to the upper end of the gutter.

Procedure.—The needle is sterilized and freed from moisture. The skin, subcutaneous tissues and underlying periosteum of the sternum opposite to the 3rd or 4th intercostal space are infiltrated with novocain. The needle is inserted vertically halfway between the midline and the lateral margin of bone. It is then tilted until it makes an angle of about 30° with the surface of the skin (figure 3). With a screwing side-to-side movement, the anterior plate of the

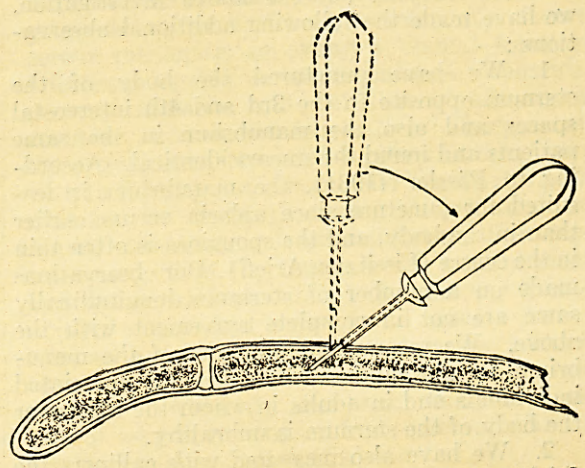

Fig. 3.—Diagram showing the position of the sternal puncture needle inside the sternum.

sternum is penetrated, and the needle pushed 1 cm. deep. When the bevelled surface of the needle is kept facing downwards, it should travel parallel to the surface of the sternum. When the needle has been driven to the required depth, the guard should have travelled through the entire thickness of the soft tissues and have just penetrated the periosteum. The advantage with the oblique puncture is the elimination of the danger of mediastinal penetration even when 2 cms. of needle is pushed into the sternum. (If desired, the needle can be used for a vertical puncture also.) The needle is now rotated once or twice clockwise and withdrawn with the guard *in situ*. This protects the marrow from being wiped off the needle by the soft tissues during withdrawal. Enough solid marrow can be scraped out of the gutter with a needle to make half a dozen smears. These have to be made very thin, as otherwise there will be overcrowding of cells and individual cells cannot be distinguished. When it is desired to culture the marrow for pathogenic organisms, the marrow from the gutter can be inoculated into appropriate media by removing it with a sterilized platinum loop.

We have used this needle extensively on cadavers and later on anæmic and kala-azar patients admitted into the General Hospital, Madras. The advantages we claim are :—

1. The operative technique is very simple, involving the handling of a single instrument.

2. Bone marrow undiluted with blood is invariably obtained, whereas with aspiration, occasionally dry punctures may result or only blood be withdrawn.

3. Smears made from the marrow show sheets of cells with their anatomical relations undisturbed. Both immature cells and megakaryocytes are seen in large numbers (figure 4, plate XVIII).

4. In kala-azar, numerous parasitized cells are found unruptured, thus saving time in the search for parasites.

While carrying out the above investigation, we have made the following additional observations :—

1. We have punctured the body of the sternum opposite to the 3rd and 4th intercostal spaces and also the manubrium in the same patients and found the smears identical. According to Pässler (1931), the manubrium is less suited for puncture since aplasia occurs earlier than in the body, and the spongiosa is often thin in the centre (Lissitzyn, Arieff). Our observations made on a number of sternums longitudinally sawn are not in complete agreement with the above. We recommend puncture of the manubrium in all children, in thin and emaciated individuals and in adults in whom the skin over the body of the sternum is unhealthy.

2. We have also measured with callipers the thickness of the bared sternum in the middle line corresponding to 1st to 5th intercostal spaces. The average measurements were 10.7, 10.4, 9.3, 9.2, and 9.5 mms., opposite to the 1st, 2nd, 3rd, 4th and 5th, intercostal spaces respectively. The safe distance a needle can be pushed by the oblique method which we advocate is 15.0, 14.9, 14.0 and 14.3 mms. respectively. Other advantages with the oblique puncture are (1) it is easier to push the needle in, (2) no stop is necessary since there is not the remotest chance of penetration into the mediastinum, and (3) bone marrow over a long distance is included in the specimen removed. The pain and discomfort experienced by the patient are in no way greater than with the vertical puncture.

We are at present engaged in a study of the total and differential counts of marrow removed by this method in normal individuals. According to Segerdahl (1935), nucleated cell counts in aspirated bone marrow of healthy men are 75,000 per c.mm. with a variation of 38,400 and in women 82,700 per c.mm. with a variation of 24,100 per c.mm. Greif (1937, 1938) has recorded that the counts vary from 45,000 to 150,000 per c.mm. These figures show that the counts hitherto published are very variable, and these variations, even after providing for the lability of bone marrow, are mostly due to dilution with blood (figure 5, plate XVIII). We feel confident that with our technique, errors due to the second factor can be eliminated. Preliminary counts done with marrow removed from the cadavers in accidental deaths reveal a higher percentage of immature cells.

The differential counts as published to-day are again at variance and unsatisfactory, as the leucocytes of the admixed blood are necessarily added to the cells of the marrow. This naturally results in inflation of the leucocytic count and an incorrect myeloid-erythroid ratio from which granulopoietic and erythropoietic activity can be judged. It should be possible to enumerate the cells more accurately in future, since undiluted marrow is obtained with the present needle.

The use of this needle has been demonstrated at a clinical meeting of the General Hospital, Madras, on 28th July, 1945. At present the instrument is in use in almost all the wards of the institution, and the consensus of opinion is that it is very satisfactory and superior to Salah's needle.

Summary

A new sternal puncture needle to obtain undiluted bone marrow with ease is described. The needle is simple in construction, unlike Salah's needle, and dispenses with suction with a syringe. The advantages and superiority of the new technique in the study of bone marrow are pointed out. Immature cells and megakaryocytes are found in greater numbers ; Leishman-Donovan bodies in kala-azar are detected with ease ; total and differential counts of both myeloid and erythroid cells in the marrow can be carried out correctly, since dilution with blood is eliminated.

I have to thank Lieut.-Colonel G. R. McRobert, I.M.S., former Professor of Medicine, Medical College, Madras, and Physician, General Hospital, who encouraged me in my hæmatological work, and the Superintendent and Physicians of the General Hospital for facilities afforded to me to perform sternal puncture on patients under their care.

I am extremely grateful to United Surgical Works Ltd., a local surgical instrument manufacturing company, Mount Road, Madras, for making the needle to my design. It may be obtained from them.

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[The author of this paper has been good enough to send to us one of these needles for trial. Owing to difficulty in obtaining suitable steel, the preparation of these needles has apparently been a little difficult; if suitable steel is not used, the canalated needle is not strong enough and may break during use, the broken needle being difficult to remove. The firm mentioned supplied one needle, and then asked for it to be returned and supplied another apparently made of better steel.—Editor, *I.M.G.*]

PLATE XVIII

JAUNDICE IN AMŒBIC LIVER ABSCESS : D. GOVINDA REDDY & C. MOHAN RANGAM. PAGE 501.

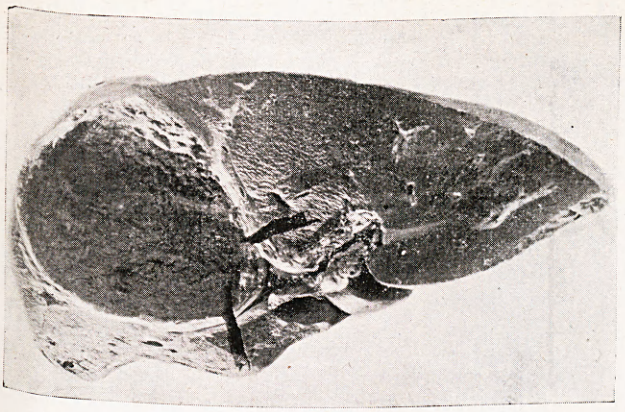

Fig. 1.—Sagittal section of the liver in case 1, showing a solitary abscess with thick fibrous wall pressing at its lower pole on the right hepatic duct.

Fig. 2.—Low power photomicrograph of a section made from the wall of the abscess proximal to the occluded bile duct showing dilated tortuous bile ducts surrounded by fibrous tissue and inflammatory cells.

Fig. 3.—Medium power photomicrograph of a section made from the necrotic material inside the abscess showing amœbæ.

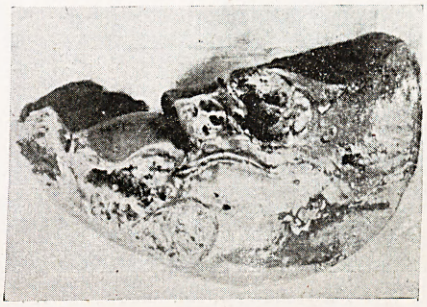

Fig. 4.—Sagittal section of the liver in case 2, showing honey-combed abscesses in the right lobe. The posterior aspect of the anterior half of the liver is shown in the photograph.

A NEW TECHNIQUE IN STERNAL PUNCTURE : D. GOVINDA REDDY & M. THANGAVELU. PAGE 502.

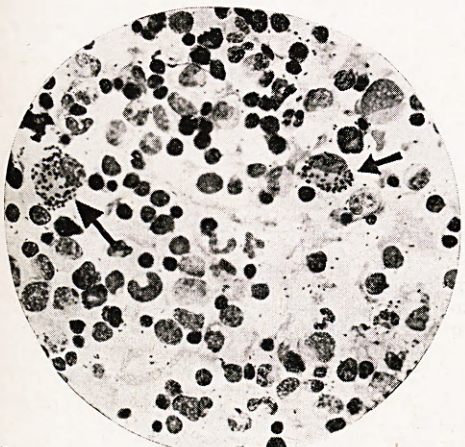

Fig. 4.—Photomicrograph of smear preparation of sternal bone marrow obtained with Reddy's needle. Marrow cells are found in large numbers with very few red blood cells. Two entire cells loaded with Leishman-Donovan bodies are seen. Stained with hæmatoxylin and eosin. × 500.

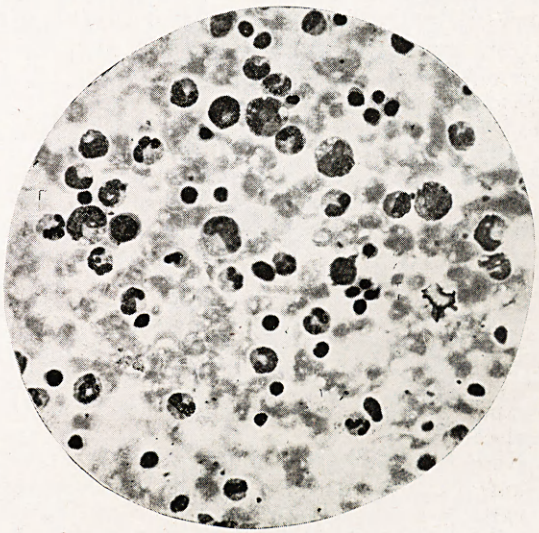

Fig. 5.—Photomicrograph of smear preparation of sternal marrow obtained with Salah's needle from the same case. Note marked dilution with red blood cells and sparse immature cells. Stained with hæmatoxylin and eosin. × 500.