bacilli from the joint aspirates rule out a tuberculous arthritis.

The clinical picture is consistent with rheumatoid arthritis, although the Rose-Waaler test is only weakly positive. The continued pain and elevated ESR suggest that there is persistent inflammatory or destructive activity in the joints. Radiological deterioration in the joints has been associated with an increase in the number of subarticular cysts. Another unusual radiological feature is the occurrence of areas of circumscribed opacities in the soft tissues of the fingers. These lesions consisted merely of amorphous debris but no urate deposits were detected.

These findings are in many ways similar to those described in Bywaters' patients. As in our patient, staphylococci were occasionally isolated from the sinuses. He postulated that bone cysts were formed by the propulsion of synovial fluid into the cancellous bone under the inflamed joint surfaces which were denuded of cartilage. Necrotic fragments of bone resulting from stress microfractures were extruded from the cysts and were eventually discharged through the skin, forming sinuses. The track, at first sterile, might become secondarily infected with staphylococci. In the case described above, bone cysts are associated at some sites with thin-walled sacs beside the shafts of the bone. It is

possible that debris from the joint or from destroyed subarticular bone has remained in the subcutaneous tissue and has become surrounded by a fibrous wall.

We conclude that these chronic sinuses and multiple bone cysts are manifestations of the destructive features of rheumatoid arthritis. Steroid therapy has not been given to the above patient because of her already immobile state, her age, and the relative lack of severe symptoms, and it is not yet known whether the chronic destructive process could be suppressed by such treatment.

Summary

A patient with rheumatoid arthritis is described in whom fistulae have developed near affected joints. Investigations have shown that the fistulae communicate with neighbouring disorganised joints. Rheumatoid changes and necrotic bone were demonstrated in the wall of such a fistula.

It is postulated that bony sequestra, detached from severely involved joints, are discharged to the surface through these fistulae.

We thank Lord Amulree for permission to publish this case and Dr. C. J. Dickinson for his helpful criticism. We are grateful to Dr. P. M. Sutton for his report on the biopsies and to Dr. S. Cochrane Shanks who kindly reported on the X-rays.

REFERENCES

- ARLET, J., MOLE, J. (1961): Association de Goutte et de Polyarthrite Chronique avec Ténosynovite Necrotique Fistulisée, *Rev. Rhum.*, **28**, 320.
 BYWATERS, E. G. L. (1953): Fistulous Rheumatism—A Manifestation of Rheumatoid Arthritis, *Ann. rheum. Dis.*, **12**, 114.

PASTEURELLA SEPTICA MENINGITIS WITH SURVIVAL

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HUMAN infections with *Pasteurella septica* have been divided by Talbot and Sneath (1960) into two groups, namely, those with and those without a history of animal bites. The majority fall into the first group and usually show local infection and adenitis (Allott, Cruikshank, Cyrlas-Williams, Glass, Mezer, Straker and Tee, 1944). Infections in the second group involve the respiratory tract (Cawson and Talbot, 1955) or take a systemic form with meningitis or bacteraemia (Schwartz and Kunz, 1959; Bearn, Jacobs and McCarty, 1955).

Meningitis due to *P. septica* is extremely rare. We have been able to trace only 14 reported cases (Regamey, 1939 (four cases); Le Chuiton, Bideau and Pennaneac, 1939; Kapel, 1942; Fölmer and Have, 1943; Tomic-Karovic and Ivanonic, 1944; Zeller and Lepper, 1950 (two cases); Lewis, 1953; Ewan, 1955; Swartz and Kunz, 1959; Talbot

and Sneath, 1960). Six of these cases were fatal. With the exception of the case mentioned by Talbot and Sneath (1960), there has been no report of *P. septica* meningitis in this country.

In this paper a case of *P. septica* meningitis with recovery in a Mongol infant is reported.

Case History

A Mongol girl aged six months was admitted to Lewisham Hospital on 2.11.61, having fed poorly and vomited for 24 hours. She had had five convulsions in the 12 hours prior to admission. The mother's pregnancy and delivery were normal, the child was bottle fed and her weight on admission was 14 lb. 10 oz.

On examination the temperature was 102.5°F., pulse 160/min., the anterior fontanelle was full and the fauces slightly reddened. There was doubtful reddening of the left ear drum. Lumbar puncture was performed at once. The CSF was turbid, there were 19,500 poly-

morphs/mm.³ and 500 lymphocytes/mm.³, protein 95 mg./100 ml. and sugar 14 mg./100 ml. A gram-stained film of the centrifuged deposit was reported: 'Gram-negative diplococci are present in small numbers, about half being intracellular'.

Treatment with intramuscular penicillin (500,000 units six-hourly) was commenced and there was some clinical improvement, although the temperature remained high. The CSF on 7.11.61 contained 120 polymorphs/mm.³ and 71 lymphocytes/mm.³, protein 80 mg./100 ml. and sugar 42 mg./100 ml. No organisms were seen on the gram film and culture was sterile. Treatment was changed to sulphadiazine 3 g./day and chloramphenicol 375 mg./day with striking improvement in the child's condition. Pulse and temperature were normal within 48 hours and the patient discharged 12 days after admission. At subsequent visits to the out-patient department the baby appeared to be making the progress expected for a Mongol child.

Bacteriological Investigations

Morphology and Cultural Characteristics. Cultures of the CSF taken on admission grew small (1 to 2 mm. diameter) shiny grey colonies on blood and chocolate agar in 24 hours at 37°C. The cultures had a distinct odour. Gram films from these colonies showed pleomorphic gram-negative organisms, the majority being small cocci with some short rods and a few filamentous forms. A thin capsule was demonstrable. In later subcultures, particularly under unfavourable conditions—for example, on salt and bile-salt agar (on which the organism grew poorly)—bacillary forms predominated and bipolar staining was seen. The organism grew only moderately well anaerobically and at room temperature. It was non-motile.

Biochemical Reactions. The organism reduced nitrates and produced indole and catalase. Gelatin was not liquefied. Methyl red and Voges Proskauer tests were negative and there was no growth in Koser's citrate. Acid with no gas was produced in peptone water sugars from lactose, glucose, sucrose and mannitol within 24 hours and from glycerol in 72 hours. There was no action in 14 days on maltose, dulcitol, raffinose, sorbitol, dextrin, arabinose, mannose and inositol. Several attempts to demonstrate H₂S formation and methylene blue reduction were unsuccessful.

Antibiotic Sensitivity. Tests were made on blood agar using a filter-paper disc technique. Wide zones of inhibition of growth were obtained with penicillin (1.5 units/disc), streptomycin (30 µg./disc), chloramphenicol (30 µg./disc), tetracycline (30 µg./disc) and sulphonamides (1 mgm./disc).

Animal Pathogenicity. Two guinea-pigs were injected intraperitoneally with 0.5 ml. of a 24-hour peptone water culture of opacity equal to Brown's tube 2. Both animals died within 18 hours and the organism was seen in large numbers in the peritoneal fluid and recovered from the blood, spleen and brain. A rabbit given 1 ml. of a similar culture intravenously died in less than 24 hours. At autopsy the lungs showed patchy collapse. Cultures of heart blood, lungs, liver and spleen were positive.

A provisional identification of this organism as *Pasteurella septica* was made. This was confirmed by Dr. J. M. Talbot by its serological behaviour.

No history of animal bites or scratches was obtained from the baby's mother, although a dog had been in close contact with the child. *P. septica* was not isolated from the dog's mouth and throat.

Discussion

The clinical features of this case presented no

unusual signs or symptoms. We have been given permission to describe in greater detail the fatal case mentioned by Talbot and Sneath (1960).

A woman of 75 was admitted to hospital with drowsiness, neck rigidity and a positive Kernig's sign. The CSF contained 2,000 cells/mm.³, of which 95% were polymorphs, and a moderate number of gram-negative coccobacilli, both intra- and extracellular, were seen in the gram film. The organism was eventually identified as *P. septica* and was only 'moderately sensitive' to penicillin. The patient died within 24 hours of admission. A history of a cat-scratch two weeks before the onset of the illness was obtained and *P. septica* was isolated from the animal (personal communication).

From the scanty information available three routes of meningeal infection by *P. septica* seem possible:

- (1) Open injury to the meninges following fracture of the skull (Regamey, 1939).
- (2) Animal bites with subsequent blood stream spread and localization in the meninges (case mentioned by Talbot and Sneath, 1960).
- (3) Apparently spontaneously (Swartz and Kunz, 1959). In such cases a possible focus may be middle-ear disease (Ewan, 1955) or the lungs (Swartz and Kunz, 1959).

The difficulties of bacteriological identification arise mainly from the rarity of the infection. In gram films of the CSF the organism has been confused with *H. influenzae* and, as in the present case, the coccal appearance may lead to erroneous identification as *N. meningitidis*, a view partly supported by the positive oxidase reaction given by the colonies on primary culture. The small size and pleomorphic features of the organism, combined with its ability to grow on such unfavourable media as salt agar at room temperature, exclude these two possibilities.

Another group of bacteria considered while bacteriological investigations were being made was the Mima tribe (de Bord, 1942), a gram-negative pleomorphic organism isolated from cases of conjunctivitis and vaginitis and also from the CSF in meningitis (Spreccace and Dunkelberg, 1961). This organism frequently has a diplococcal appearance, leading to confusion with the pathogenic *Neisseria*, and de Bord drew particular attention to its possible identification as *N. gonorrhoeae* in cases of vaginitis. Of this genus only the species *Herellea* produces acid without gas from carbohydrates. As *Herellea* and the closely related *B. amitratum* (Schaub and Hauber, 1948) do not reduce nitrates, they are easily distinguished from *P. septica*.

Only six cases of *P. septica* meningitis have been reported since the introduction of antibiotics and of these three were fatal. It is not possible to be certain which antibiotic is most effective in treatment. Lewis's case and Talbot and Sneath's case were given massive doses of penicillin parenterally, but died within a few hours and two days respectively after treatment was commenced. In the case reported by Swartz and Kunz chloramphenicol,

penicillin and streptomycin were given, the streptomycin by the intrathecal route, but the patient died three days after admission.

Of the three cases that survived, one received sulphadiazine alone for 23 days, one was given very high doses of penicillin intramuscularly and sulphadiazine orally for two weeks and Ewan's case received sulphadiazine, streptomycin and penicillin, but the dose, route and duration of treatment are not recorded.

P. septicæ varies in its sensitivity to antibiotics other than penicillin and sensitivity tests are required to control treatment. None of the cases described have received intrathecal penicillin and, although the present case received large doses of penicillin parenterally, the CSF penicillin level may

still have been inadequate. The improvement in the child's condition when chloramphenicol was introduced appears to support the conclusion. In view of Needham's (1948) finding that less than 1 unit of penicillin/ml. is required to inhibit the growth of *P. septicæ* *in vitro*, it would be expected that penicillin would be the treatment of choice.

Summary

A case of meningitis in a Mongol child due to *Pasteurella septicæ* is reported. The difficulties in identifying the causative organism are discussed.

We wish to thank Dr. McMillan, in whose department this work was done, Dr. Gans for permission to quote the clinical details of the case and Dr. J. M. Talbot for confirming the identity of the organism serologically.

REFERENCES

- ALLOTT, E. N., CRUIKSHANK, R., CYRLAS-WILLIAMS, R., GLASS, V., MEZER, I. H., STRAKER, E. A., and TEE, G. (1944): Infection of Cat-bite and Dog-bite Wounds with *Pasteurella Septica*, *J. Path. Bact.*, **56**, 411.
- BEARN, A. G., JACOBS, K., and MCCARTY, M. (1955): *Pasteurella Multocida* Septicæmia in Man, *Amer. J. Med.*, **18**, 167.
- CAWSON, R. A., and TALBOT, J. M. (1955): The Occurrence of Past. Septicæmia (syn. Multocida) in Bronchiectasis, *J. clin. Path.*, **8**, 49.
- DE BORD, C. G. (1942): Description of Mimeæ Trib. Nov. with Three Genera and Three Species and Two new Species of Neisseria from Conjunctivitis and Vaginitis, *Iowa state Coll. J. Sci.*, **16**, 471.
- EWAN, E. P. (1955): Case of Meningitis due to *Pasteurella Multocida*, *Canad. J. M. Technol.*, **17**, 56.
- FOLMER, P. R., and HAVE, B. T. (1943): Ein Geval von *Pasteurella-Meningitis*, *Ned. T. Verlosk*, **3**, 1378.
- KAPPEL, O. (1942): Pasteurellose hos Mennesket, *Nord. méd.*, **14**, 1229.
- LE CHUITON, F., BIDEAU, J., and PENNANEAC, H. J. (1939): A propos d'une Pasteurelle isolée du liquide céphalo rachidien dans un cas de traumatisme crânien, *C.R. Soc. Biol. (Paris)*, **130**, 1096.
- LEWIS, M. L. (1953): Fatal Meningitis with Septicemia Caused by *Pasteurella Multocida*, *Amer. J. Clin. Path.*, **23**, 24.
- NEEDHAM, G. M. (1948): Penicillin in Treatment of Experimental Infection with *Pasteurella Multocida*, *Proc. Med. Clin.*, **23**, 361.
- REGAMEY, R. (1939): 'Les Infections Humaines a B. Bipolaris Septicus'. Berne: Hans Huber.
- SCHAUB, I. G., and HAUBER, F. D. (1948): Biochemical and Serological Study of Group of Identical Unidentified Gram-negative Bacilli from Human Sources, *J. Bact.*, **56**, 379.
- SWARTZ, M. N., and KUNZ, L. J. (1959): *Pasteurella Multocida* Infections in Man: Report on Two Cases—Meningitis and Infected Cat Bite, *New Engl. J. Med.*, **261**, 889.
- SPRECACE, G. A., and DUNKELBERG, W. E. (1961): Mima Polymorpha—Causative Agent in Acute and Chronic Meningitis, *J. Amer. med. Ass.*, **177**, 706.
- TALBOT, J. M., and SNEATH, P. H. A. (1960): A Taxonomic Study of *Pasteurella Septica*, especially of Strains Isolated from Human Sources, *J. gen. Microbiol.*, **2**, 303.
- TOMIĆ-KAROVIĆ, KRUNOSLAVA, and IVANONIĆ, MATO (1944): Klinischer Beitrag Zur Frage der Pathogenität der Baktrien aus der *Pasteurella* Gruppe, *Ann. pædiat. (Basel)*, **163**, 177.
- ZELLER, W. W., and LEPPER, M. H. (1950): Meningitis due to *Pasteurella* other than *Pasteurella Tularensis* and *Pasteurella Pestis*, *Amer. J. Med.*, **9**, 701.

SALMONELLA MENINGITIS IN THE NEWBORN

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MENINGITIS due to organisms of the *Salmonella* family is regarded as a rare event, though there are a number of references in the literature.

It has a particular predilection for the newborn period and a very high mortality at this time. Present methods of treatment are unsatisfactory and it is in order to draw attention to this, and to

increase awareness of this potential hazard in the neonatal period that this case is presented.

Case Report

In November, 1960, there was an extensive outbreak of *Salmonella Typhimurium* Phage la Var. 1, which probably started in a bakery from cream-filled cakes.