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CHRONIC OSTEOMYELITIS

A Report of Fifty Cases Treated with Lincomycin (Lincocin®)

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Chronic osteomyelitis still represents a subject for discussion at orthopaedic meetings (Nordisk Ortopædisk Forening's 34th Assembly 1968) and articles in orthopaedic literature (Taylor & Mausley 1970, Rowling 1970). The cause is that chronic osteomyelitis still represents a challenge to the orthopaedic surgeon, the disease including an ischaemic as well as an infectious component.

Surgery is required to remove the ischaemic tissues which comprise both necrotic bone tissue and scar tissue. Removal of bony abscess cavities may require chiseling of non-necrotic bone to prevent retention by forming a gutter instead of a well. Foreign bodies should usually be removed, but in the case of infected fractures it may be advisable to postpone the removal of osteosynthesis material until the fracture has healed. The operative field may be closed primarily, perhaps after the bone cavity has been filled with bone chips, muscle or subcutaneous tissue, or the wound may be left to secondary healing following the methods of Winnett Orr (1927) and Trueta (1939). It is often advisable to perfuse the wound with physiologic saline solution either as a continuous drip or with several forced perfusions per day. This can be continued for from several days to more than a week. Skin transplantation to cover raw bone surfaces, or after the wound has closed, may become advisable.

Which form of local treatment should be chosen in the actual case must be decided by the surgeon in each case. Perhaps in this decision it is more a question of medical art than profession.

The fight against the infection is based upon a strengthening of the patient's general condition and chemotherapy. Sufficient food both in quality and quantity, extra doses of vitamins, and correction of anaemia if necessary by blood transfusions are factors to remember. The

chemotherapy should be based on a drug that fulfils the following criteria (Herrell 1968):

1. It should concentrate well in bone.
2. It should be highly active against penicillinase-producing as well as nonpenicillinase-producing staphylococci.
3. The development of resistance, if it does occur, should be slow or delayed.
4. It should show little or no cross-resistance with the commonly used antibiotics.
5. It should be relatively nontoxic, permitting its prolonged use in the treatment of chronic osteomyelitis.

Before chemotherapy is started, it is important to try to find the causative organisms and their sensitivity to different chemotherapeutic agents. Since we are not so pressed for time in chronic osteomyelitis as in acute osteomyelitis, it is possible to perform adequate sensitivity studies. Immediate culture on agar gives the best opportunity for positive results. In recurring osteomyelitis without sinus formation, it is advisable to permit the organism time to grow, with production of pus, and not arrest its onset too early. The chemotherapy should probably be started before the operation, but the ultimate results do not seem to be better by instituting therapy earlier than a few days before operation. The dosages should be sufficient to give the proper blood concentration for the drug to enter the bone lesion in necessary concentration despite the reduced vascularity. The drug may also be given locally, e.g. as an addition to the perfusion fluid.

When the results of the treatment of chronic osteomyelitis are evaluated, it should be kept in mind that chronic osteomyelitis, like the Sleeping Beauty, can awake after many years of sleep. It is therefore better to use solely descriptive expressions as: no symptoms, no signs, or healed, and not say cured.

In 1969 (Holloway) reviewed the literature on the treatment of osteomyelitis with lincomycin (Lincocin®) and reported a "cure rate" of 79.6 per cent in 172 patients with chronic osteomyelitis. The purpose of this paper is to report the results with lincomycin therapy in 50 consecutive patients with chronic osteomyelitis or arthritis, excepting three with lincomycin-resistant organisms. There is no intention to evaluate the effectiveness of lincomycin compared to other drugs. It may, however, be mentioned that there are good reasons to think that Lincocin fulfils Herrell's criteria for chemotherapy.

CLINICAL RESULTS

The patients were between 5 and 76 years old with a history of osteomyelitis between 3 months and 55 years. The histories are summarized as follows:

Therapeutic misadventures in		18 cases
osteosynthesis	8 cases	
other operations	8 –	
intraarticular injections	1 –	
wire traction	1 –	
Acute osteomyelitis in		14 –
Infected compound fracture in		10 –
Secondary infection in active tuberculous joint in		5 –
Secondary infection in earlier tuberculous joint in		3 –

The osteomyelitis was localized in hip or femur in 25 of the 50 cases.

Specimens from all patients were examined for infecting organisms. Staph. aureus was found in 44 cases, alone in 34 cases and mixed with other organisms in 10. In 4 cases, organisms other than Staph. aureus were found, and in 2 cases there was no growth. All cases but 4 were examined for their sensitivity to lincomycin and found positive. Phage typing was done in only about one-third of the cases.

The dosage was usually 500 mg lincomycin four times a day to adults, continuing about four weeks following healing; then the dosage was reduced to 500 mg twice a day. Children received smaller dosages. Patients were treated locally with radical saucerization, with less radical operation, or even without any operation. According to the condition, primary closure of the wound was employed, with or without postoperative perfusion of the wound, or the patients were treated according to Winnett Orr and Trueta's method.

Of the 50 patients, 47 healed and 41 remained healed for an observation period lasting from nine months to three years ten months. In 6 patients the condition recurred, but following new treatment, 3 healed once more and have remained healed for one year ten months to two years eight months.

The results were more impressive for patients who were *operated,* and particularly for those who were operated most radically, than for patients who were not operated. This deserves particular attention since the groups are not identical—the patients who were most radically operated were those who were estimated to be the most serious

cases. This observation supports the assertion that chronic osteomyelitis is as much an ischaemic as an infectious problem.

Operation	Total treated	Healed and remained healed	Healed but recurred	Failure
Saucerization	17	16	–	1
Other operations:				
Sequestrectomy	8	7	–	1
Currettement, incision, removal of nail	11	8	3	–
No operation	14	10	3	1
	50	41	6	3

The *duration of lincomycin treatment* was significant. This applies for the total length of time as well as for the time following healing. Again, the patient groups were not identical, but those who were treated for a long time usually were those who were estimated to be the most serious cases. In spite of this, 27 out of 29 cases with more than three months' duration of lincomycin treatment following healing remained healed, whereas only 5 of 9 less serious cases, who were treated less than one month after healing, remained healed.

Duration of medication after healing	Total healed	Remained healed	Healed but recurred
More than 3 months	29	27	2
1–3 months	9	9	–
Less than 1 month	9	5	4
	47	41	6

The 3 patients with recurrence, who healed after another lincomycin treatment that was continued more than one month after healing, have remained healed.

To decide whether the operation or the duration of medication was most important for the results, the patients should be grouped in operated and not operated and these groups be divided in patients given drugs for more than three months, one to three months, or less

than one month. With not more than 50 patients altogether, the groups get small. In addition the groups are not identical, as e.g. the patients supposed to be most seriously affected are within the operated, long time treated group. This study thus does not justify any conclusion or comparison of the importance of operation contra duration of medication. With this reservation, some figures may be reported.

Duration of medication after healing	Total healed	Remained healed	Healed but recurred
	Operated patients		
More than 3 months	23	21	2
1–3 months	6	6	
Less than 1 month	5	4	1
	34	31	3
	Not operated patients		
More than 3 months	6	6	
1–3 months	3	3	
Less than 1 month	4	1	3
	13	10	3

The *bacteriological condition* was of importance as the results were best in patients who had only lincomycin-sensitive organisms. Altogether, nine patients had both lincomycin-sensitive and lincomycin-resistant organisms and were also treated with other chemotherapy, e.g. anti-tuberculosis drugs. The lincomycin-sensitive organisms usually disappeared, but the mixed infection continued in some cases:

Lincomycin sensitivity	Total treated	Remained healed	Healed but recurred	Failure
Sensitive alone	35	31	4	–
Sensitive and not sensitive	9	5	1	3
Sensitivity not tested, or no growth	6	5	1	–
	50	41	6	3

The *duration of the disease* had no apparent effect on results. For example, the group of 10–55 years' history includes 4 patients with a duration of more than 50 years, another 4 with a duration of 40–49 years, and altogether, 13 of the 14 had a duration of more than 20 years.

Duration	Total treated	Remained healed	Healed but recurred	Failure
10–55 years	14	12	1	1
1–10 years	20	17	3	–
Less than 1 year	16	12	2	2
	50	41	6	3

The *cause of the osteomyelitis,* its *localization,* or the *age of the patient* had no influence on the results as far as this could be judged from the few patients studied.

The 6 cases which recurred and 3 which failed to heal should be examined a little more closely:

1. In 3 of the cases with sensitive organisms, but which recurred, the reason was probably that the medication was stopped within two weeks following healing. One case also had foreign bodies in the form of osteosynthesis material, but since he had serious heart disease and his osteomyelitis had improved so much that it bothered him only minimally, he did not undergo operation.
2. The fourth patient with only sensitive organisms who recurred, probably had insufficient saucerization since there were huge masses of new bone around the infected Thompson prosthesis.
3. In the fifth case with recurrence, the reason was probably also deficient operation since we did not find any sequestrum, but two sequestras were found by a second operation following the recurrence, after which he has remained healed for eight months.
4. The sixth patient had a tuberculous arthritis of a sacroiliacal joint with mixed infection with Staph. aureus. She had two recurrences; the first may have been caused by stopping treatment less than two weeks after healing. The cause for her second re-

currence may have been that she did not take her drugs for long periods of time.

5. Two of the cases which failed to heal had mixed infections with Pseudomonas aeruginosa. During treatment the Staph. aureus. disappeared and the condition improved considerably, but the Pseudomonas did not disappear.
6. The last patient had a tuberculous knee with Staph. aureus and in addition had cancer of the skin covering a large area in front of the knee.

Finally, it should be mentioned that all recurrences appeared within the first year following healing, namely, after one, one, four, six, eight, 10 and 11 months, inclusive of the case who had her second recurrence after eight months. On the other hand, no recurrence was observed after 11 months in 40 patients observed for more than one year from healing.

SUMMARY

Fifty patients were treated with lincomycin because of chronic osteomyelitis or arthritis: 47 healed and 41 remained healed for periods of observation lasting between nine months and three years ten months. Of six patients with recurrence, three healed and have remained healed for one year ten months to two years eight months following a second treatment.

The results were superior if the patient underwent radical operation with saucerization and when the chemotherapy was continued at least for one month and in serious cases for more than three months after healing.

In patients with mixed infections, the lincomycin-sensitive organism usually disappeared, but the resistant organism did not always disappear in spite of treatment with adequate chemotherapy.

The cause of osteomyelitis, its localization, and the length of duration had no influence on the result: 13 of the patients had a duration longer than 20 years, 8 longer than 40 years, and 4 longer than 50 years.

The causes of recurrence and failure to heal are probably inadequate duration of medication following healing or insufficient operation, or mixed infection with resistant organisms.

All recurrences appeared within one year after healing, and no recurrences appeared in 40 patients observed for more than one year.

CONCLUSIONS

Lincomycin has given good results in this series of 50 patients with chronic osteomyelitis and/or arthritis. It does not obviate the need for operation, but the chemotherapy should be supplemented with removal of dead and ischaemic tissues. We would encourage other investigators to report their findings with the concomitant application of lincomycin and appropriate surgical procedures in the treatment of this often discouraging and recurrent condition.

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