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PROLONGED EXTRADURAL ANAESTHESIA WITH BUPIVACAINE AT LUMBAGO AND SCIATICA

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The treatment of pain in the back, better defined as lumbago, with or without sciatica is a problem all doctors are confronted with. Hardly any benign pain condition torments the sufferers more. It results in mental strain in the form of insomnia, immobilization, "tablet eating", and possibly treatment by doctor, manipulator, or quack.

There are few symptom complexes that can be treated in so many different ways. Common to all the methods is the object of freeing the patient from pain, of mobilizing him, and of getting him back to work. To attain this, symptomatic and operative treatment is applied.

Extradural anaesthesia is a form of treatment described as early as the beginning of the present century (Cathelin 1901, Caussade & Queste 1909). It has since had positive criticism from a number of authors in different countries (Cosmes 1961, Cyriax 1961, Eriksson 1962, Goebert et al. 1960, Korkeila 1966, Nolte & Puente-Egido 1969). Correctly carried out, the method presents slight risks irrespective of whether the sacral or the lumbar path is chosen to deposit the anaesthetic in the extradural space. Cyraix (1961) reported 20,000 cases treated with extradural anaesthetic, where only three showed mild complications, all of which regressed. Coomes (1961) treated 20 ambulatory cases and found in a comparative investigation that the convalescence period averaged 11 days, whereas for 20 conservatively treated cases the period was 31 days.

The anaesthetic has also been combined with hydrocortisone preparation with good results. Goebert (1960) obtained excellent results in 73 per cent of 113 cases. Eriksson (1962) reported 21 cases treated with prolonged extradural anaesthesia. Of these, 16 became symptom-free; the others proved to have disc degeneration, except for one with a mental condition.

At Skellefteå hospital, prolonged extradural anaesthesia, since 1966,

has been an increasingly appreciated method for the treatment of lumbago and sciatica.

MATERIAL

Our material consists of 96 patients: 45 women, average age 49.5 years (21 to 88 years) and 51 men, average age 50.8 years (29 to 70 years). Sex and age distribution is shown in Figure 1. The 96 patients were given a total of 116 doses of the anaesthetic. Anaesthesia block was induced in 16 patients on two occasions and in one patient on four occasions. In 1966, there were 18; in 1967, 30; in 1968–1970, 68. The latter 68 blocks were carefully noted on special forms, whereas information concerning the first 48 blocks was obtained from the patients' case records, which in some instances resulted in insufficient information. Thus we cannot account for all 116 blocks.

All patients were treated at the medical clinic, except for one who was admitted to the surgical clinic.

The 116 blocks were induced on the following indications: lumbago-sciatica 91, sciatica 15, lumbago 10.

The symptom complexes were divided into the following groups:

Lumbago-sciatica: pains in the lumbar region radiating into one or both legs.

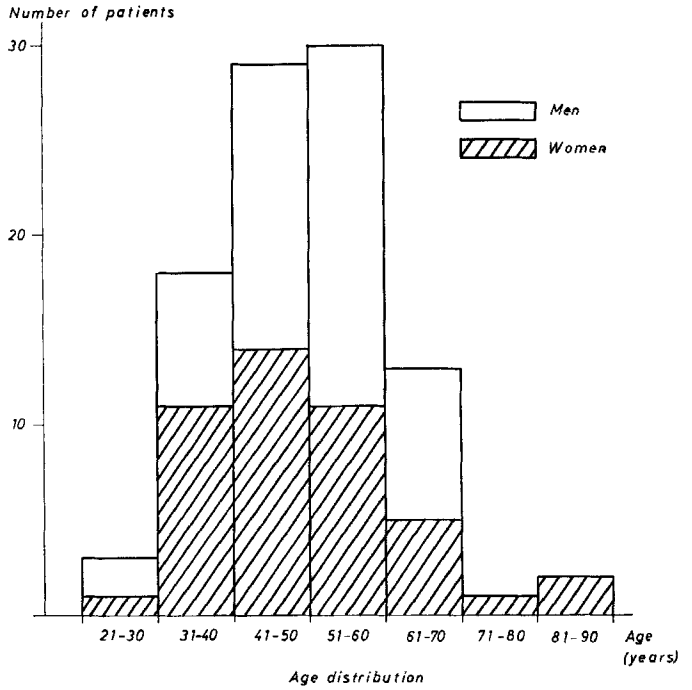


Figure 1.

Sciatica: pains localized to the gluteal region radiating into one or both legs.
Lumbago: only dull, dead pain in the lumbar region.

The material consisted of patients who had been referred to the hospital or admitted from the hospital clinics. All patients were moderately to severely immobilized and suffered pain also in lying position, resulting in insomnia and considerable consumption of analgesics as well as injection preparations.

METHOD

We used Tuhoy-needle, usually applied in the interstice between the 3rd and 4th lumbar vertebrae. The extradural space was identified by the "loss-of-resistance" method, whereupon 10 ml 0.25 per cent bupivacaine with adrenaline 1:200,000 (Marcain-Adrenalin®) was injected. A Portex extradural catheter was introduced through the needle so that *circa* 5 cm was estimated to be in the extradural space. The other end of the catheter was provided with a Viggo's membrane coupling, which was fixed with plaster to the patient's chest. After half-an-hour's observation of, among other things, blood pressure, the patient was transferred to the ward. A new dose of the anaesthetic was injected through the membrane coupling when the effect of the previous dose had worn off. The size of the iteration doses did not exceed 10 ml,

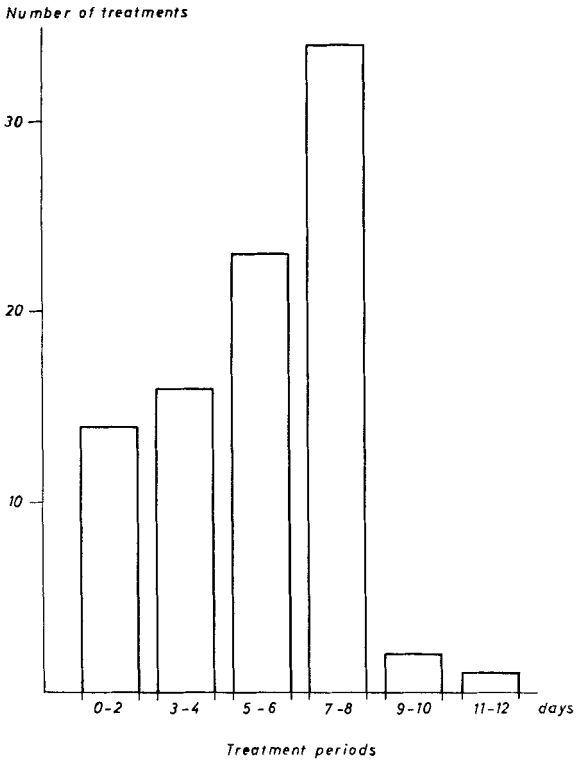


Figure 2.

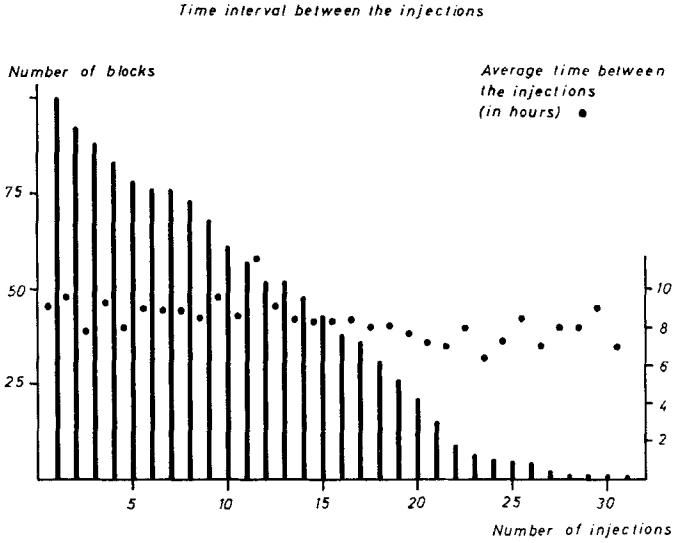


Figure 3.

and the effect of the immediately previous dose was the deciding factor for the size of the current dose. These injections were given by the nurses in the ward. The patient was not allowed to leave his bed during the first half-hour immediately after the injection; thereafter, if possible, the patient was mobilized. The catheter was usually withdrawn on the 8th day or earlier. In individual instances, the treatment continued longer.

RESULTS

The following parameters in the material were examined:

a. The length of treatment period for each patient (Figure 2).
b. The time intervals between the injections (Figure 3).
c. The total amount of anaesthetic given to each patient (Figure 4).
d. The total amount of anaesthetic given per day and patient (Table 1).
e. The time interval before mobilization of the patients.
f. The relation between effect and X-ray finding (Table 2).
g. Complications (Table 5).
h. Changes in blood pressure.
i. Toxic liver effect.

a. Figure 2 shows the treatment periods for 90 extradural anaesthesias. In one case, the maximum treatment period amounted to 10 days and 8 hours. The catheter was withdrawn within 24 hours in 8

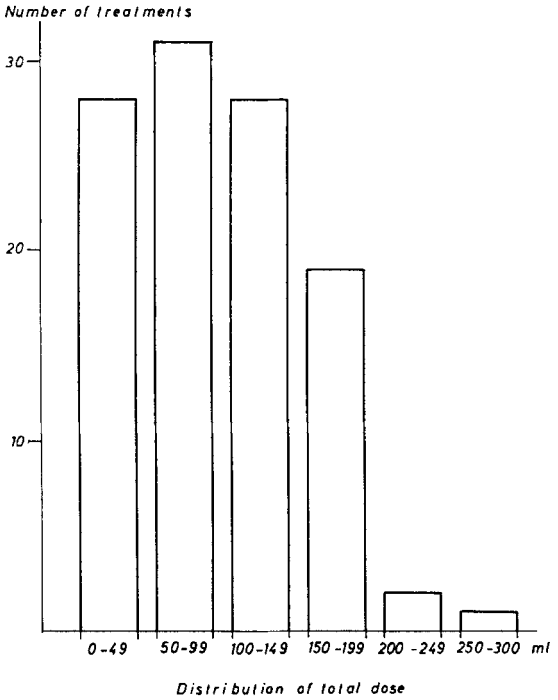


Figure 4.

cases. 96.6 per cent of all the treatments were discontinued within nine days.

b. Complete information about the time intervals between the injections is reported for 100 injected extradural anaesthetics. The intervals between the injections averaged 8 hours 48 minutes, which could be directly correlated to the duration of the anaesthetic. As Figure 3 shows, the average values of the time intervals vary from 6.4 to 11.6 hours (3 to 90 hours), but no guaranteed increase or decrease is demonstrable with rising number of injections. One patient had maximum 31 injections. In 100 injected extradural anaesthesias, 12.5 were given on average.

c. The total amount of anaesthetic given in each individual case in 108 performed blocks is shown in Figure 4. Only three patients were given more than 200 ml; one had a maximum of 256 ml; the total dose in one case was only 13 ml. The average value of the total dose was 99.2 ml.

d. Information about the amount of anaesthetics given per day

Table 1. Dose per day.

Number of days	1	2	3	4	5	6	7	8	9	10	11	12
Number of blocks	107	105	98	90	86	72	64	61	4	1	1	0
Total of the given amounts of anaesthetics in ml	15.8	17.5	16.3	16.0	14.7	14.9	14.3	7.0	12.5	24.0	16.0	0
Mean of average amounts in ml given per day	1696	1842	1593	1460	1266	1074	918	432	50	24	16	0

exists for 107 treatments. This amount varied from 0 to 60 ml per day and patient. The average value of the daily dose was 15 ml. As long as the number of anaesthesias was representative, only slight variations are found in the average dose, except for the 8th day (Table 1) when the dose was reduced to 7 ml. This could be due to the treatment being terminated on the 8th day; the last dose was given in relation to the withdrawal of the catheter. Thus the number of blocks was, on this day, reduced from 61 to 4, i. e. a reduction of 52.7 per cent of the total.

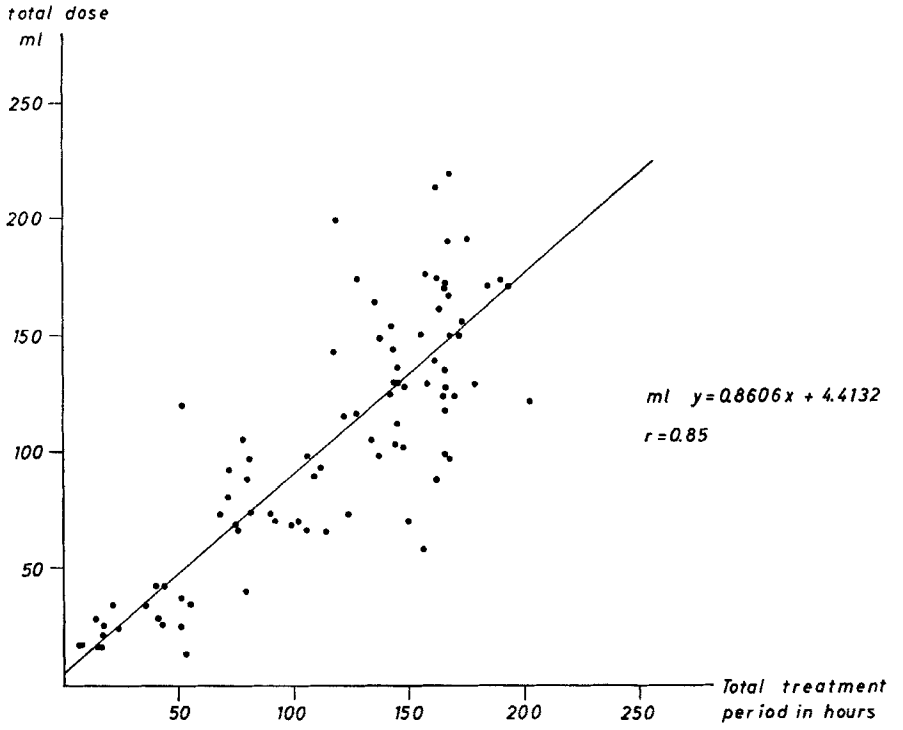
The statistical relation between total dose and total treatment period at 90 blocks was calculated. The correlation was positive with the correlation coefficient 0.85, which is strongly significantly different from 0 ($P < 0.001$). Figure 5 shows how the dose increased with the length of the treatment period.

e. The time interval from the primary injection to the mobilization was investigated in 56 patients. No patient was allowed to get up during the first half-hour after the injection. The maximum time before the mobilization was 450 minutes in one case. Already after the first half-hour, 25 patients could get up, and within one hour, 44 patients. The average time before rising from the bed was 65 minutes.

f. All 116 blocks were included in the investigation of the correlation between effect and X-ray finding. Information about the X-ray findings were, with few exceptions, taken from the report of our X-ray department. No notice was taken of kyphosis, lordosis, or scoliosis. No demonstrable anomalies were noted. Norms for the effect of the

Table 2. Correlation of effect and X-ray findings

Effect of injection treatment	Spondylosis	Spondylosis + disc degeneration	Disc degeneration	X-ray/without visible changes	X-ray/not carried out	Number of blocks	Per cent
None	0	3	3	2	0	8	6.9
Moderate	1	2	5	1	4	13	11.2
Good	1	8	8	8	3	28	24.1
Very good	15	29	6	10	7	67	57.8
Number of blocks	17	42	22	21	14	116	100
Per cent	14.6	36.2	19.0	18.1	12.1	100	



Relation between treatment period and total dose

Figure 5.

blocks were determined beforehand (Table 3). Cases with complications of the type that necessitated removal of the catheter were designated "no effect". All six patients (two of whom had blocks on two occasions) with "no effect" are specified in Table 4. Table 2 shows that almost 82 per cent of the blocks had good to very good effect.

Table 3. Definition of the basis for appraisal of effect

Very good effect	Immediate pain relief. Mobilization and exercises were begun without appreciable difficulties. Discharge without, or with only insignificant, symptoms.
Good effect	Slight to moderate symptoms during the treatment. Mobilization and exercises with moderate difficulty. Discharge with remaining, but fundamentally relieved, symptoms.
Moderate effect	Visibly noticeable improvement. Difficulties with mobilization and exercises. Discharge with moderate but less symptoms.
No effect	Slight relief during the treatment, or no relief. Much difficulty with mobilization. No improvement at discharge.

Table 4. Cases where "no effect" was achieved.

Sex	Age	Diagnosis	X-ray/finding	Treatment period (days)	Complications	Comments
♂	45	Lumbago Sciatica	Disc degeneration	2	Saddle block anaesthesia	
♂	46	Lumbago Sciatica	Disc degeneration	8	-----	After 4 days, new catheter. Treatment continued for 7 days
♀	48	Lumbago	Spondylosis Disc degeneration	2	Headache	
♀	67	Lumbago Sciatica	Spondylosis Disc degeneration	2	-----	After one day, new catheter. Treatment continued for 3 days. Operated 1964 for adenocarcinoma recti No metastases
♀	56	Lumbago	No changes	6	Pain where catheter introduced	Treated 1964 at psychiatric clinic Diagnosed: psychastenia + polysymptomatic
♀	41	Lumbago Sciatica	No changes	3	Paresis in right leg	Total paresis of the leg after each injection

Table 5. Complications.

Sex	Age	Diagnosis	X-ray/finding	Effect	Treatment period (days)	Complications	Comments
♂	45	Lumbago Sciatica	Disc degeneration	None	2	Saddle block anaesthesia	
♂	48	Lumbago	Spondylosis Disc degeneration	None	2	Headache	
♀	37	Sciatica	Disc degeneration	Good	8	Headache	Treated 1967 at psychiatric clinic Diagnosed: Reactio hysterica
♀	56	Lumbago	No changes	None	6	Pain where catheter introduced	No local reaction. Treated 1964 at psychiatric clinic. Diagnosed: psychasthenia + depression + polysymptomatic
♀	50	Lumbago Sciatica	Disc degeneration	Moderate	6	Pain where catheter introduced	No local reaction
♀	41	Lumbago Sciatica	No changes	None	3	Paresis	Total paresis in right leg after each injection
♀	35	Lumbago Sciatica	Spondylosis	Very good	6	Paresis	Paresis in both legs after each injection
♂	48	Sciatica	No changes	Good	7	Tremor	Tremor only after primary injection
♂	66	Lumbago Sciatica	Spondylosis Disc degeneration	Very good	7	Felt cold after 3 days	No local reaction. Catheter withdrawn. New catheter introduced after one week
♂	56	Lumbago Sciatica	Spondylosis Disc degeneration	Very good	6	On 6th day, temp. 38°C 100°F). (Cause obscure)	No local reactions

g. No case with really serious complications was found, nor was there any case with signs of infection or of total spinal anaesthesia. The bladder paresis described by Belfrage & Raabe (1970) in connexion with prolonged extradural anaesthesia at partus was not observed by us. Table 5 reports 10 patients with complications, all of which regressed spontaneously before discharge from the hospital. No complications were observed in 4 patients who suffered from diabetes mellitus. Change of catheter was made in 12 patients within one week. The cause of this was leakage in the catheter tubing, coupling joint, or because the catheter had been occluded or, in one instance, had slid out.

h. Blood pressure conditions were recorded during the first hour after the primary injection and after the first injection in the ward. In 58 patients, the blood pressure fell after the primary injection an average of 14.7 ± 1.4 per cent. The maximum blood pressure fall was 43.7 per cent, three patients showed no change in blood pressure, and in another, it rose by 18.2 per cent.

Changes in blood pressure after the first injection in the ward were recorded in 55 patients. The fall in blood pressure averaged 12.5 ± 1.0 per cent. One patient had a reduction in blood pressure of 26.0 per cent, one showed no change, and two showed an increase of 4.5 per cent. No statistically guaranteed difference could be demonstrated between the fall in blood pressure after the primary injection and the fall after the first injection in the ward.

i. 62 patients were examined to find out whether during the treatment there were any changes in the thymol reaction, Takata's reaction, alkaline phosphatases, and GPT content. Changes were observed only in alkaline phosphatases and GPT, and these were completely within the limits for normal values.

DISCUSSION

Although different opinions prevail concerning the aetiology and treatment principles, there is, none the less, one common goal for all who treat "bad backs": to make the patients symptom-free.

For the most difficult cases of lumbago or sciatica, we used continuous extradural block, which proved satisfactory both to the patient and to the doctor. Because of our positive results with only the minimum of complications, this form of treatment has become routine with us.

In animal experiments, bupivacaine has proved to be essentially

more tissue irritating than mepivacaine; it also has four times as high acute toxicity (Henn & Brattsand 1966). On the other hand, bupivacaine is normally given clinically in a concentration four times lower than mepivacaine. We could never find any signs of aseptic inflammation nor any signs of liver injury after the use of bupivacaine 0.25 per cent with adrenaline.

In two cases, the catheter was withdrawn on the third and the sixth day, respectively, because of rise in temperature for some obscure reason. In one case, a new catheter was reintroduced within one week. No relation could be found between the rise in temperature and the treatment in progress. Diabetes mellitus was not found to be a contraindication. The risk of infection in the richly vascularized peridural tissue is apparently small. To reduce the risks of infection, careful sterilization was naturally observed; moreover, an anaesthetic with long duration was chosen. This meant longer intervals between injections. Earlier comparable studies have shown that bupivacaine has considerably longer duration than mepivacaine and lidocaine. In our material, we found an average duration of 8 hours 45 minutes between the injections. This corresponds well to earlier investigations (Watt, Rose & Atkinson 1968, Ekblom & Widman 1966, Lind 1965, Hollmén 1966, Nolte & Puente-Egido 1969).

Tetracaine has been proved to cause 66 per cent more paresis than bupivacaine in 0.5 per cent solution (Bromage 1969). In agreement with this, the patients in our material showed no noticeable pareses or loss of sensibility in the lower extremities, except for two. We could not find any explanation for these two, but they perhaps were sensitive to the anaesthetic.

At the introduction of the Tuhoy-needle, the interstice that we could most easily identify was used, usually that between the 3rd and 4th lumbar vertebrae, and the needle point was directed cranially. There is no guaranteed criterion for the direction the catheter takes in the extradural space (Moore 1965). Thus it is possible that in the patient who developed saddle block anaesthesia the catheter went caudally and produced the same anaesthesia as at sacral block.

We did not hesitate to use the treatment for three patients who had earlier been operated on for disc degeneration. Two of them were operated on two occasions. The effect on two of the three was very good and on one good. There were no difficulties in applying the catheter, except for one where we did not succeed until a renewed attempt was made a day later.

The frequency of patients with tremor seems to depend on the amount of adrenaline (Ervin 1964). We had one patient with tremor who was successfully treated with 25 mg pethidine i. v. The highest recommended single dose of bupivacaine is 150 mg, but we never found it necessary to administer more than 25 mg, and the highest 24-hour dose was 150 mg. Thus doses far below the expected risk of toxic effect were used.

We had two patients with temporary headaches. Evans (1930) reported that in connexion with extradural anaesthesia an increased intrathecal pressure arose which can possibly cause headache. We did not observe any changes in blood pressure that called for medical treatment, nor did any patient complain of symptoms that could be referred to changes in blood pressure.

The amounts of anaesthetics given daily and the time intervals between the injections varied only insignificantly. We failed to find with bupivacaine the tachyphylaxis that Moore (1965) describes in connection with lidocaine and mepivacaine.

Our criterion for applying block for lumbago and sciatica was solely the intensity of the pain and the degree of immobilization. We find it impossible in some cases to apply the recommendations found in the literature concerning solely strict bed rest and analgesics in the acute phase (Thompson 1970). We noted in some patients threatening decubitus induced by pronounced immobilization in connexion with severe pain. Prolonged extradural block resulted in dramatic pain relief and almost immediate mobilization. Thus early X-ray examination could also be carried out, whereupon patients with demonstrated disc herniation could be referred to a special clinic. As Coomes (1961) showed, there is a shorter recovery period for patients treated with extradural block than for those treated conservatively. A pain circle is interrupted, and perhaps a form of spontaneous reposition takes place. Perhaps the results could be further improved if different forms of treatment were combined (Kaltenborn & Brodin 1966).

Thus, we consider that the prolonged extradural anaesthesia with bupivacaine is an attractive form of treatment for backache. Complications are few, slight, and reversible. However, we do not wish to express an opinion about the possible therapeutic effect of the method. What we do is to keep the patient free from pain and mobile. In this way, we avoid the conventional analgesics, which have a doubtful effect and sometimes severe side effects.

We have, moreover, a distinct impression that most of the patients

treated in this way do not return to the hospital complaining of backache. We are planning at present a more detailed examination of sick-listed periods and frequency of recurrences.

SUMMARY

116 prolonged extradural blocks in 96 patients with lumbago or sciatica are reported. We used the "loss-of-resistance" method. The anaesthetic was bupivacaine 0.25 per cent with adrenaline 1:200,000. The patients were mobilized on average 65 minutes after the primary injection. We found good to very good effect in about 82 per cent of the patients. The treatment period was more than 8 days for only 4 patients. Iteration intervals of the anaesthetic averaged 8 hours 48 minutes. The average dose of anaesthetic per patient and day was 15 ml, the total average dose was 99.2 ml. The fall in systolic blood pressure was statistically significant and amounted to 15.2 per cent after the primary injection and 13.1 per cent after the first injection in the ward. The material includes six "no effect" cases and ten with complications, all of which regressed. No toxic liver effect was found. There were no disadvantages shown when using the method on patients with diabetes mellitus or patients earlier operated for disc herniation. Tachyphylaxis was not noted. The usefulness of the method by itself or in combination with other treatment principles is discussed.

ACKNOWLEDGEMENT

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REFERENCES

Belfrage, P. & Raabe, N. (1970) Kontinuerlig lumbal epidural analgesi vid vaginal-förlossning. *Läkartidningen* **67** (48), 5661–5668.

Bromage, P. R. (1969) A comparison of bupivacaine and tetracaine in epidural analgesia for surgery. *Canad. Anaesth. Soc. J.* **16** (1), 37–45.

Cathelin, F. (1901) *C. R. Soc. Biol. (Paris)* **53**, 452.

Caussade, G. & Queste, P. (1909) *Bull. Soc. méd. Hôp. Paris* **28**, 865.

Coomes, E. N. (1961) A comparison between epidural anaesthesia and bed rest in sciatica. *Brit. med. J.* **1**, 20–24.

Cyriax, J. (1961) Epidural anaesthesia and bed rest in sciatica. *Brit. med. J.* **1**, 428.

Ekblom, L. & Widman, B. (1966) A comparison of the properties of LAC-43, prilocain and mepivacaine in extradural anaesthesia. *Acta anaesth. scand.* Suppl. XXI, 33–43.

Eriksson, E. (1962) Kontinuerlig epiduralanestesi vid lumbago-ischias. *Svenska Läk.-Tidn.* **59**, 3721–3726.

Ervin, A. (1964) Erfarenheter av 5000 epiduralanestesier. *Nord. Med.* **72**, 1141–1145.

Evans, W. (1930) Intrasacral epidural injection in the treatment of sciatica. *Lancet* **2**, 1225–1229.

Goebert, W. W., Jallo, S. J., Gardner, J. & Wasmuth, C. E. (1960) Sciatica treatment with epidural hydrocortisone. Scientific exhibit, Congress of American Society of Anesthesiologists, Nov. 1960, New York.

Henn, F. & Brattsand, R. (1966) Some pharmacological and toxicological properties of a new long-acting local analgesic, LAC-43 (Marcaine®), in comparison with mepivacaine and tetracaine. *Acta anaesth. scand.*, Suppl. XXI, 9–30.

Hollmén, A. (1966) Axillary plexus block. *Acta anaesth. scand.*, Suppl. XXI, 53–65.

Kaltenborn, F. & Brodin, H. (1966) *Manipulation av ryggraden*, p. 119. Scandinavian University Books, Lund.

Korkeila, J. (1966) LAC-43-clinical experiences with a new long-acting local anaesthetic agent in epidural anaesthesia. *Acta anaesth. scand.*, Suppl. XXIII, 453–461.

Lind, B. (1965) LAC-43. Et nytt lokalanaestheticum med lang virkningstid. *T. norske Laegeforen.* **85**, 1613–1615.

Moore, D. C. (1965) *Regional block*, pp. 436–437. Charles C. Thomas, Springfield, Ill.

Nolte, H. & Puente-Egido, J. J. (1969) Das neue Lokalanaestheticum Bupivacain (Carbostesin) in der klinischen Anwendung. *Anaesthesist* **18** (8), 264–265.

Thompson, M. (1970) Low back pain and sciatica. *Rheumatology Clinic Update* **2**, 1023–1030.

Watt, M. J., Ross, D. M. & Atkinson, R. S. (1968) A double-blind trial of bupivacaine and lignocaine. Latency and duration in extradural blockade. *Anaesthesia* **23** (3), 331–337.