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The present series of "A clinical study of Epidural Morphine, Pethidine, Pentazocine and Fentanyl for post-operative analgesia" has been carried out on a series of 87 cases.

Provision of post-operative analgesia has been a great challenge to the anaesthesiologists. It involves pain-relief, general well being and escape from the side-effects of post-anaesthetic complications. The post-operative pain, as well warrants the close watch on the part of the attending house staff and nurses.

The conventional methods of injecting the analgesics for post-operative analgesia become very cumbersome. There have to be repeated injections, in fairly high doses, which in their own turns, produce various side effects.

The identification by Snyder of specific receptors which are sensitive to narcotics, in the substantia gelatinosa of posterior horn cells of spinal cord, in 1975, has opened up new concepts of treatment for pain and narcotic addiction. Opiate drugs are known to extract a direct anti-nociceptive influence on the spinal cord (Yaksh and Rudy, 1977, 1978). Drugs injected in the epidural space do reach the spinal cord finally
and this explains the ultimate action of epidurally injected morphine directly on opiate receptors.

Behar et al. (1979) used epidural morphine for the relief of pain. Further studies made by Majora et al. (1980), also established encouraging results.

The present study has thus been taken under cover of the encouraging results by previous workers to establish a method for providing post-operative pain relief by epidural administration of various analgesic drugs. This provides pain relief for a much longer duration and the dose required is much less as compared to those needed for conventional routes.

The series comprised of patients of both sexes; no relationship has been found in respect of sex with the degree of pain relief.

**Selection of cases and anaesthetic technique:**

The cases studied in the present series consisted mostly of major surgeries, which needed post-operative pain relief for a comparatively longer period, say upto 70-80 hours.

The technique of anaesthesia had been epidural and general anaesthesia using inhalational anaesthetics and relaxants.
We administered epidural analgesics to most of the cases (73.56%) for surgery, so that we could introduce the analgesics drugs through the same canula in the post-operative period. This method avoided the necessity of introducing epidural canula in the post-operative period when the patient may be unco-operative.

13.79% cases got operated under general anaesthesia using an inhalational agent and 12.69% cases with relaxants. In these cases, the epidural canula was inserted first.

The administration of the analgesic drug was done as soon as the patient started feeling slight discomfort.

The drugs given by other conventional methods, if used at the start of pain, required larger doses and since the onset is longer, the patient is in agony for sometime. The preferrable timing in these cases has to be before the onset of pain which at times, becomes difficult to judge.

**Dose of the drug:**

The dosage of the drug, used for epidural administration, has been quite small. Morphine 3 mg., as against 10-15 mg. for other conventional
routes, was used. Pethidine was administered in two
dosages viz 10 mg. and 50 mg.. Cousins et al. (1979)
had used the same in the dosage of 100 mg.. We
observed that as low a dose of 10 mg. provided pain
relief to same extent. With the increase in dosage,
the duration of analgesia was increased.

Pentazocine had been used in the
dosages of 7.5 mg. and 15 mg.. The low dose has also
been quite effective, but again similar to that of
pethidine, the degree and duration of pain relief is
enhanced with the increase in dosage.

Fentanyl was used in the dose of 0.1 mg.
which is far less than that given through other routes
but provides effective pain relief, though of shorter
duration.

The dose requirement has been dependent
upon the site of surgery also. The upperabdominal
surgeries needed more dosage repetitions than the
perineal and limb surgeries. The female genital
surgery cases, also needed more dosage of the drug.
This has been true with all the drugs. (Tables 12-16).

Onset of action:

Onset of action with all the drugs viz.
morphine, pethidine, pentazocine and fentanyl, given
epidurally, came out to be between 2-10 minutes. Our observations fully corroborate with the findings of Behar et al., (1979). In his series, with epidural morphine, the onset of action had been within 5 minutes. Cousins et al., (1979) used 100 mg. epidural pethidine and onset of action had been 5-6 minutes.

The onset of action of pain relief by intramuscular route, is fairly long and the patient has to be in agony for a longer period. Even the intravenous injection takes quite a few minutes for the onset of action. The rate of complications is much enhanced by these routes. The dose requirement is usually high. We observed that the epidural administration of the drugs, even in very small doses, had a quick onset.

**Duration of action:**

The stipulated period for provision of post-operative analgesia, in our series, had been for 72 hours or more than that. The first dose of the epidural analgesic was given just at the onset of slight discomfort in the post-operative period. The observations in our series are as follows:-

**Morphine:** We used the drug in 3 mg. dose. The duration of action, in 68% cases had been for 10-20 hours. It is in accordance with the findings of Joan et al., (1980).
In their series of duration of analgesia was 12.2 hours in post-operative prostatectomy cases. 12% cases had pain relief for more than 72 hours. Thus we see that even as small a dose as that of 3 mg. is sufficient to provide pain relief for more than 5 days, whereas the requirement with other conventional routes must have been multiple pricks involving higher doses resulting into side-effects and addiction etc. This would also involve constant attendance on the part of junior doctors and the nursing staff. By extending pain relief through the epidural method, the required attendance on the part of the treating staff and anxiety on the part of the attendants of the patient become for less.

In the series of Behar et al., the duration of action had been 6-24 hours whereas in that of Bapat et al., it was 3-24 hours. These workers found that duration of action in acute cases was less than that in chronic cases.

In 47.6% cases the duration of analgesia lasted for 20-30 hours (Table, 6). Similar results were obtained by Andrews and Surendran (1980). In their series of 13 cases analgesia lasted for 24 hours in 10 cases.

The subsequent repetition of dosage increased the duration of analgesia. The second dose
was sufficient to produce analgesia for about 19.5% cases, whereas repetition of the drug to some patients was required even for 5 times, extending pain relief for the desired period (Table 6-9).

The total dose required in different sites of operation, has also been variable and we observe that upper abdominal surgery cases needed epidural analgesic administration for 4.6 times (mean dose) (Table -12). The female pelvic operations needed 4.6 times dose-repetition (mean dose) for the same period (Table-12).

Pethidine (10 mg.): We used epidural pethidine in dosage of 10 mg. in a series of 10 cases. The duration of analgesia with this small dose has been less than 10 hours in 90% cases in the first instance (Table-6). For extending pain relief for more than 72 hours we had to give epidural pethidine in this dose for 6 times in most of the cases. 10 mg. pethidine is too small a dose but we find even this efficacious, though the repetitions of the drug are many.

Pethidine (50 mg.): With the increase in the dose of the drug, we observed that the degree and duration of analgesia increased considerably. 26.6% cases had analgesia for more than 72 hours even with the first
dose. About 85% had the same by fourth dose (Tables 6-8). Other workers like Cousins et al. (1979) used 100 mg. epidural pethidine for pain relief. Simultaneously they measured CSF pethidine concentration. They observed onset of pain relief as 5 minutes which coincided with the presence of high concentration of pethidine in CSF (0.5-2 mg. per litre). Complete pain relief occurred at 10-12 minutes (CSF level being 10-20 mg. per litre) and mean duration of action being 6 hours (range 4.5-20 hours).

We find, through our studies, that the dose requirement of pethidine even at 50 mg. is considerably effective for prolonged degree and duration of analgesia. If we employ higher dosage then the complications and side effects will definitely be increased (Table-13).

Rutter et al., (1981) compared the results of morphine, pethidine and fentanyl using 2 mg., 50 mg. and 0.1 mg. respectively. They concluded the results by using a visual linear analogue. Pethidine was found to be least effective, morphine as longest acting and fentanyl had a relatively shorter duration of action.

In our series we found better results with pethidine 50 mg.. The fourth dose of the drug
achieved success in 85.7% cases, while the similar dose of morphine succeeded in 75% cases for giving pain relief for more than 72 hours (Table -11).

Pentazocine: Epidural pentazocine has not been used by other workers, as post-operative analgesic, hence no literature is available on it. We used 7.5 mg. dose in 10 and 15 mg. dose in 15 patients.

The degree and duration of analgesia with this drug has also been quite encouraging. 15mg. dose of the drug was sufficient to extend pain relief for the desired period to about 33.3% cases (Table -5) which has been more than that with morphine or pethidine. 7.5 mg. pentazocine of course has not been effective for longer duration. In the majority of the cases, even 5 and 6 doses had to be given for achieving the results.

Maximum number of 4 doses were necessary in few to provide complete pain relief for more than 72 hours (Table -9).

Fentanyl: Epidural fentanyl was first used by Wolfe et al., (1979) in the form of 0.1 mg. in 8 ml. 0.9% normal saline. Pain relief started in 4-10 minutes and lasted for 200-400 minutes, with a peak action in 20 minutes. In our series of 12 cases who were given epidural fentanyl as post-operative analgesic,
pain relief did not extend for more than 2-3 hours with the first dose of fentanyl and 2.5-3.5 hours with the second dose. We did not give fentanyl to our cases after the second dose as the duration of analgesia was too short and achievement of our aim remained suspicious. The cases were then kept on parenteral routes. Rutter et al.,(1981) also observed the duration of epidural fentanyl being very short (2 hours).

Degree of analgesia:

The response of the epidural analgesic has been classified as Excellent, Fair and Poor.

We found that fentanyl had excellent response as compared with pethidine and morphine. The duration of action has been very less with this drug. Our observations in respect with this drug are in total agreement with that of Rutter et al.,(1981).

15 mg. pentazocine and 50 mg. pethidine also had very good results. They have been judged better analgesics used epidurally for achieving post-operative analgesia (Table -30). Our observations do not tally with those made by Rutter et al.,(1981) who found 2 mg. morphine to be more effective than 50 mg. pethidine.

There has been poor response, in our
series, in one case each, with 3 mg. morphine, 50 mg. pethidine and 15 mg. pentazocine which could be attributed to the faulty position of the catheter.

The response of the drug used had been very encouraging. Their degree of analgesia had been much superior to those of the drugs used parenterally.

**Pulse and Blood pressure:**

There has been no significant effect of the drug on cardiovascular system (Student's t test). What ever changes, in respect to pulse and blood-pressure, were there, they were only on account of stress of surgery and anaesthesia.

In the immediate post-operative period there was tachycardia that is most probably on account of pain. Any change in blood pressure is not related with the epidural administration of the drugs. Other workers also did not notice any cardio-vascular variations. Wolfe et al. (1979) found no significant alterations in heart rate, blood pressure or consciousness level with fentanyl and Kararia et al. (1981) did not notice any fall in blood pressure or change in pulse rate after epidural morphine.

**Respiratory rate and Tidal volume:**

In our series, no significant change
was observed in the cases of minor lower abdominal, pelvic, perineal and limb surgeries, in respiratory rate and tidal volume with any of the drug used. Similar findings were observed by Kataria et al., 1981 with morphine and by Wolfe et al., 1979 with fentanyl 0.1 mg. for respiratory rate.

Changes were significant particularly with upper abdominal surgeries and lower major abdominal surgeries, where the respiratory rate was increased and tidal volume was reduced at the onset of pain, but 10 and 30 minutes after epidural dose, respiratory rate decreased and tidal volume was found to be raised. With morphine these changes were statistically significant except for the changes in tidal volume after 30 minutes of epidural drug. With pethidine group no change was found to be significant while with fortwin, significant changes were observed in respiratory rate after 30 minutes of injecting drug epidurally. Changes in respiratory rate and tidal volume, 10 and 30 minutes after giving drug were statistically significant (student t test) (Tables 24-29), with fentanyl.

Complications and side effects:

We observed the following complications in our series.

Nausea: It was more with epidural morphine and slightly
less with pethidine 50 mg..Bapat et al.,(1979) in
their series found nausea in 17% cases with pethidine,
where as we observed in 14.3% cases.
Vomiting: With epidural morphine, vomiting was observed
in 12.6% cases. Reiz et al.,(1980) reported the incidence
of nausea and vomiting in 17% cases in their series.
Retention of urine was observed in 25. cases with
morphine series and 21.4% cases of pethidine (50 mg.)
series. It could not be clearly attributed on account
of the drug as post-operative retention of urine is
seen following many operations. Other workers - Magora
et al., 1980; Reiz et al., 1980 and Andrews and Surendran
1981 also reported the incidence of urinary retention
after epidural morphine. They attributed it to the
increased tone of detrusor muscle and of the vesical
sphincter, thus impending micturition.
Cephalic discomfort: This had been the most observed
distress. It actually did not cause pain but the presence
of catheter in the epidural space has always been taken
notice of. There had been a feeling of discomfort. The
patients reconcilled after its purpose was explained to
them.

Moreover this discomfort can be caused by
the piercing of ligaments by a thick 16 gauze Tuohy
needle, which was used for this purpose.

The incidence of complications has been
much less than when the drugs are used by other routes, as the total dose requirement of the drug is much less. The incidence of side effects is directly proportional to the amount of drug administered.

In none of our cases, itching was observed with epidural morphine as countered by Heiz et al., (1980); Hales (1980) and Andrews and Surendran (1981), in their cases. No case of respiratory depression was encountered, the finding being contrary to those of Glynn et al., (1979); Scott and McInerney (1979); Boas, (1980) and Welch, (1981).

None of the case in our series got sensory or motor loss with any drug when given epidurally, coinciding with the findings of Bagora et al., 1980, who experimented upon morphine.

Thus in this study we have seen that the epidural administration of analgesic drugs is far too superior in the degree and duration of analgesia in the post-operative phase. There occur no significant cardiovascular alterations. The respiratory rate is not decreased. In case of upper abdominal surgery, there is splintage of the diaphragm on account of pain. The patient is unable to ventilate his lungs effectively. The tidal volume is affected.

If we keep such cases under conventional
methods of analgesia, significant results are not achieved. With epidural administration of analgesics we have seen that effective analgesia is achieved and better ventilatory conditions are maintained.

Thus the effective achievement of degree and duration of analgesia with much smaller dose in quantity and frequency goes a great way in making this method definitely a superior technique for post-operative analgesia. With the added advantage of having minimum side effects, the procedure becomes still more beneficial.