# CONTINUOUS INTRA-VENOUS ALTHESIN AS AN ADJUNCT IN NEURO-ANAESTHESIA — A NINE MONTH EXPERIENCE

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## SYNOPSIS

**Althesin, an intra-venous anaesthetic, by reducing the cerebral metabolic rate ($CMRO_2$) and the cerebral blood flow (CBF) also lowers the intracranial pressure (ICP). Over a nine month period, 38 patients presenting for neurosurgery were anaesthetised using continuous Althesin infusion as an adjunct. This study showed that Althesin infusion provided adequate operating conditions in 32 patients. Recovery was rapid, thus permiting early neurological assessment. No major complications were encountered.**


## INTRODUCTION

Althesin is a steroid mixture consisting of 0.09% w/v alphaxalone and 0.03% w/v alphadolone 21 — acetate in a 20% solution of polyoxyethylated castor oil (Cremaphor EL). (1) Initially introduced in 1971 as an anaesthetic induction agent, it ran into initial disfavour because of reported incidences of anaphylactoid reactions. (2,3) However, in recent years, Althesin has been used as a continuous intravenous anaesthetic. (4,5,6).

Beside the advantage of having very little effect on circulatory haemodynamics (7), Althesin has the ability to reduce cerebral metabolic oxygen consumption ($CMRO_2$) and decrease the cerebral blood flow (CBF). As a result of decreases in these two parameters, the intracranial pressure (ICP) is consequently lowered. (8)

## MATERIALS AND METHODS

Patients who had been anaesthetised by the author over a nine month period from October 1981 to June 1982, using continuous intravenous Althesin as an adjuvant have been included in this study. These patients presented themselves for removal of intracranial arteriovenous malformations (AVM), ECIC bypasses and clipping of cerebral aneurysms. Intravenous Althesin was not used on patients undergoing surgery for head injuries, laminectomies and cranioplasties.

The patients in which continuous Althesin infusion was used were premedicated with Pethidine (1 mg/Kg body weight), Promethazine (0.5 mg/Kg body weight) and Atropine (0.06 mg/Kg body weight up to a maximum of 0.3 mg total dose).

Anaesthesia was induced with Thiopentone (4 mg/Kg body weight) as a bolus dose, followed by d-Tubocurarine (0.6 mg/Kg) or Pancuronium (0.1 mg/Kg) for intubation. Suxamethonium was not used for intubation. If the patient moved during laryngoscopy, additional 50 — 100 mg of Thiopentone was given.

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The patients were then ventilated with a mixture of 70% $N_2O$ and 30% $O_2$. The minute volume was adjusted to maintain a $pCO_2$ of 30 — 35 torr. Muscle relaxation was maintained with either d-Tubocurarine or Pancuronium.

Althesin infusion, at a dose of 0.1 ml/kg/hour was started in all patients 13 — 30 minutes after induction of anaesthesia and continued throughout surgery. The mode of delivery of Althesin was by use of a syringe pump. The infusion of Althesin was stopped as soon as the dura was closed.

Mannitol was not used in any of these patients except in those cases where the surgeon complained that the brain was still 'tense'. In those cases, only 50ml of 25% mannitol was administered.

The patients' blood pressure and pulse rates were continuously monitored. Urine output was measured every hour. The 'slackness' of the brain after the dura was opened was noted by both the surgeon and the author.

Except in 3 cases which were ventilated post-operatively all patients were reversed with a mixture of Atrophine and Neostigmine and extubated.

TABLE 1 - Number of Cases done per month

| Type of Cases | Oct | Nov | Dec | Jan | Feb | Mar | Apr | May | Jun | Total |
|---|---|---|---|---|---|---|---|---|---|---|
| Tumours | 1 | 1 | 1 | 0 | 3 | 5 | 4 | 7 | 5 | 27 |
| Cerebral Vascular Insuffi-ciency | 1 | 0 | 0 | 0 | 0 | 0 | 1 | 1 | 0 | 3 |
| Intracerebral vascular pathology | 0 | 0 | 0 | 2 | 1 | 1 | 3 | 0 | 1 | 8 |
| Total | 2 | 1 | 1 | 2 | 4 | 6 | 8 | 8 | 6 | 38 |

TABLE 2 : AGE DISTRIBUTION OF PATIENTS

| Age in Years | Male | Female |
|---|---|---|
| 0 - 10 | 1 | 0 |
| 11 - 20 | 3 | 1 |
| 21 - 30 | 1 | 1 |
| 31 - 40 | 1 | 6 |
| 41 - 50 | 5 | 7 |
| 51 - 60 | 6 | 0 |
| 61 - 70 | 1 | 4 |
| 71 - 80 | 1 | 1 |
| > 80 | 0 | 0 |
| | 19 | 19 |

## RESULTS

### Number of cases done

During the nine month period from October 1981 to June 1982, a total of 38 patients were anaesthetised using continuous Althesin infusion as an adjuvant. A breakdown of the cases done per month can be seen in Table 1. It can be seen that initially, the cases anaesthetised using continuous Althesin from February 1982 onwards when an average of 6 cases per month were anaesthetised using this technique.

An equal number of males and females were present in this sample of 38 patients.

The patients' ages ranged from 6 years to 74 years old with a mean age of 44.8 years. The majority of the patients were in the 31 to 70 year age group with the greatest number falling in the 41 to 50 year age group (Table 2).

The average weight of the patients was 52.6 Kg with a range of 13.5 Kg to 82.5 Kg.

### Duration of Althesin infusion

The duration of Althesin infusion range from 125 minutes to 490 minutes, giving an overall mean of 303.2 minutes. The durations of Althesin infusions for the different categories of cases can be seen from Table 3.

The duration of Althesin infusion for excision of AVMs and clipping of intracranial aneurysms ranged from 225 minutes to 360 minutes, with a mean of 273 minutes. The duration needed for the excision of tumours had a greater spread of values. These ranged from 145 minutes to 490 minutes with a mean of 311.6 minutes. Operations for the excision of meningiomas and gliomas needed a longer duration of Althesin infusion than operations for the excision of pituitary tumours. The number of cases done for cerebral vascular insufficiency is too small to permit analysis.

### Effects on Blood pressure, Pulse Rates and Urine Output

The blood pressure of all 38 patients remained stable throughout the duration of Althesin infusion. In those cases where the blood pressure was artificially lowered by a 0.005% solution of Sodium nitroprusside, a cessation of the infusion allowed the blood pressure to return to its former levels.

A persistent tachycardia of more than 100 beats/minute, not related to hypotension or hypertension, was noted in 10 patients. Cessation of the Althesin infusion resulted in the return of pulse rates to resting values within 15 minutes.

Althesin infusions did not cause excessive diuresis. 20 patients had urine outputs that ranged from 30 — 50 ml/hour. 9 patients had a urine output between 50-100 ml/hour. 2 patients had a diuresis of 100-150 ml/hour while 1 patient produced urine in excess of 150 ml/hour. 6 patients were given mannitol and therefore cannot be included in this analysis of urine output.

### Suitability of Operating Conditions

In 31 patients, Althesin infusion provided adequate operating conditions without resorting to the use of Mannitol. Of the 6 patients that needed mannitol, 5 patients needed only a small dose of 50 ml. 25% mannitol before optimal operating conditions were achieved. In 1 patient, optimal operating conditions could not be achieved. The remaining patient was a patient undergoing a carotid endarterectomy. The 'slackness' of his brain could not be assessed.

### Complications

Except for a tachycardia of more than 100 beats/minute, no intra-operative complications were noted.

3 patients had a prolonged recovery time which necessitated post-operative ventilation. 2 of them finally recovered the next day. The last patient unfortunately never regained consciousness.

## DISCUSSION

Mannitol has been used routinely to decrease the ICP and to provide a 'slack' brain during neurosurgery. However, mannitol has a number of undesirable effects:

1) It causes an initial hypertension due to an influx of extra-cellular fluid into the vascular compartment. In certain cases this has led to acute left ventricular failure and pulmonary oedema.
2) Mannitol induces an uncontrolled diuresis which

TABLE 3 : DURATIONS OF ALTHESIN INFUSION

| n Minutes | 0-60 | -120 | -180 | -240 | -300 | -360 | -420 | -480 | -540 |
|---|---|---|---|---|---|---|---|---|---|
| of Cases: | | | | | | | | | |
| rs | 0 | 0 | 4 | 2 | 8 | 2 | 7 | 3 | 1 |
| ral lar ficiency | 0 | 0 | 0 | 2 | 0 | 0 | 0 | 1 | 0 |
| cerebral lar logy | 0 | 0 | 0 | 3 | 2 | 3 | 0 | 0 | 0 |

complicate fluid and electrolyte imbalance.

3) Excessive doses of mannitol can lead to hyperosmolar states.
4) The cessation of mannitol therapy has led to a rebound rise in the ICP.
5) Cerebral oedema may in fact be worsened by mannitol crossing a disrupted blood-brain barrier.

The use of continuous intravenous Althesin has none of these draw-backs. On the contrary, it provides conditions which allow major neurosurgical manouvres. This is mainly due to the lowering of the ICP as a result of reductions in the CBF and $CMRO_2$. (8,9,10).

Its rapid metabolism by the liver (1) permit patients to be awake quite soon after the intravenous infusion of Althesin is stopped. In this series, by switching off the Althesin infusion as soon as the dura was closed, the patients were usually arousable and alert after reversal from anaesthesia. This allows the patients' neurological status to be assessed soon after an operation. Jago & Restall (4), using Althesin as a total intravenous anaesthetic had a mean recovery time of 7.33 minutes, regardless of the total dose of Althesin, type of pre-medication or length of anaesthesia. Saady (11) using doses of 0.1 ml to 0.2 ml/Kg/hr and Dallas (6) using doses of 0.18 ml/Kg/hr for neurosurgical procedures also reported rapid recovery times.

Althesin has very little effect on the cardiovascular system. Sear & Prys-Roberts (7) showed that Althesin only caused modest decreases in blood pressure as a result of decreases in the peripheral vascular resistance. In fact, they found that as a result of the tachycardia, the cardiac output was increased.

Complications due to Althesin have been reported. (2,3) Their true incidence is still being debated, although it has been estimated to be between 1:1900 and 1:300(9). Reports on anaphylactic reactions have been reported in cases where intermittent, bolus doses of Althesin was used. So far, no literature on anaphylactic reactions during continuous intravenous infusion of Althesin has been documented. (12)

Althesin has also been reported to cause convulsions or unmask an epileptogenic focus. (13) This view is now disputed and workers like Chin, Havill & Rothwell (14) have successfully used Althesin in the management of status epilepticus.

## CONCLUSION

The use of continuous intravenous Althesin as an adjunct to ICP control and cerebral protection during neurosurgery is a distinct advantage over the use of mannitol. The technique using a syringe pump is safe, easy to learn and free from complications.

Recovery from Althesin is rapid and allows early neurological examination.

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