Sterility of epidural solutions: recommendations for cost-effective use
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Record Status
This is a critical abstract of an economic evaluation that meets the criteria for inclusion on NHS EED. Each abstract contains a brief summary of the methods, the results and conclusions followed by a detailed critical assessment on the reliability of the study and the conclusions drawn.

Health technology
The therapeutic administration, after 24 hours at room temperature, of epidural solutions prepared in the pharmacy department of the Yale-New Haven Hospital using aseptic techniques in a horizontal laminar airflow hood. Opioids were added to 500 mL polyethylene infusion bags containing 0.9% sodium chloride infusate. The opioids included hydromorphone, fentanyl, and morphine and/or dilute bupivacaine.

Type of intervention
Treatment.

Economic study type
Cost-effectiveness analysis.

Study population
The study population comprised infusate samples taken from solution bags that had been administered to patients in the centre, and infusate samples from solution bags that were dispensed but not administered.

Setting
The setting was secondary care. The economic study was carried out in the USA, in the Department of Anesthesiology at the Yale-New Haven Hospital.

Dates to which data relate
The study did not report either the dates when the effectiveness and resource data were gathered or the price year.

Source of effectiveness data
The evidence was derived from a single study.

Link between effectiveness and cost data
The costing was undertaken prospectively on the same patient sample as that used for the effectiveness study.

Study sample
No power calculations to determine the sample size were reported. The study sample consisted of 54 samples, 16 from solution bags administered to patients in the centre, and 38 from solution bags that had been dispensed but not administered. Samples of each infusion bag were sequentially or consecutively tested every 5 to 7 days, beginning 24 to 48 hours after preparation and continuing for as long as 158 days. The mean duration of sterility assessment was 70 days (range: 42 - 158; median 63 days) for all solutions (n=54) and 63 days (range: 47 - 91; median 62 days) for solutions administered to patients (n=16).
Study design
This was a prospective observational study that was conducted in a single medical centre. The duration of follow-up was up to 158 days.

Analysis of effectiveness
The analysis of the clinical study appears to have been conducted on an intention to treat basis. The primary outcome of the study was bacterial growth.

Effectiveness results
Of the 115 cultures prepared, positive growth was observed in 5 samples, 1 from an infusate sample administered to a patient for 24 hours and 4 from solutions dispensed but not administered. In all cases, no growth was reported for multiple subsequent cultures.

The initial positive cultures were attributed to touch contamination during the retrieval or testing process.

Clinical conclusions
The study showed that pharmacy-prepared epidural solutions containing opioid, bupivacaine and opioid-bupivacaine combinations remain sterile for much longer than the present expiry time of 24 hours, as used at the Yale-New Haven Hospital.

Measure of benefits used in the economic analysis
Since the effectiveness results showed no difference in effectiveness or clinical benefit (i.e. bacteriological status) between the intervention and the comparator, the economic analysis was based on cost-differences only (cost-minimisation).

Direct costs
Discounting was not relevant because of the short follow-up period. The quantities and the costs were not reported separately. Only a total saving per patient in each group was reported. The cost/quantity boundary adopted for the costing was that of the hospital. The source of the unit costs and the price year were not reported. The cost-saving was derived from the reduction in time associated with pharmacy-prepared epidural solutions.

Statistical analysis of costs
The costs were treated deterministically.

Indirect Costs
No indirect costs were included.

Currency
US dollars ($).

Sensitivity analysis
No areas of uncertainty were identified or investigated.

Estimated benefits used in the economic analysis
Cost results
The total cost-saving per patient was $24.25 if the expiry date of the epidural was increased to 48 hours, and $32.30 if the expiry date was increased to 72 hours.

The total cost-saving for the institution ranged from $36,375 to $48,450 per year when the room temperature hangtime expiry date was extended from 24 to 48 or 72 hours.

Synthesis of costs and benefits
Not applicable.

Authors’ conclusions
A change in policy to extend the room temperature hangtime expiry date from 24 to 48 or 72 hours would translate into savings for the hospital centre.

CRD COMMENTARY - Selection of comparators
The comparator was not explicitly stated. However, by implication, the study only compared the therapeutic administration of epidural solutions after 24 hours at room temperature and within 24 hours at room temperature, the latter being described as standard practice. You should consider whether this is a widely used practice in your own setting.

Validity of estimate of measure of effectiveness
The authors adopted bacterial growth as the measure of effectiveness. This appears to have been a valid measure of effectiveness. The sample size was small and no power calculations were reported. Hence, the sample size may have been insufficient to obtain robust results. No statistical analysis, to evaluate the significance of differences in outcomes between the two health technologies, was conducted. Therefore, the validity of the effectiveness analysis is questionable.

Validity of estimate of measure of benefit
No summary benefit measure was used in the analysis because a cost-minimisation approach was adopted.

Validity of estimate of costs
The economic perspective adopted was not stated clearly, but it is likely to have been that of the hospital. It is unclear from the study whether the cost analysis was handled credibly. Few details on the cost analysis were reported. The resource quantities and the unit costs were not reported, which may limit the generalisability of the economic analysis to other settings. The categories of costs included in the analysis were not reported clearly. It appears that the authors have limited their analysis to the cost of the epidural infusate solutions. It is also unclear what method was used to value the resources. The cost estimates are likely to be specific to the Yale New-Haven Hospital. Another drawback of the cost analysis was that statistical and sensitivity analyses were not performed on the costs. Consequently, the internal and external validity of the study may be low.

Other issues
A caveat to the study is the quality of the effectiveness data that can be obtained from this type of study design. A further caveat is the lack of a measure of benefits, which makes it difficult to draw comparisons with other studies and technologies necessary to help decision-makers in the allocation of resources.
The authors compared their findings with those of other research studies. They stated that this piece of research confirmed a prior trend of epidural solutions remaining sterile for longer than 24 hours. The authors did not report any further limitations of their study. The results were not reported selectively and the conclusions reflected the scope of the study. However, a more detailed costing exercise and description of resource use would have been more informative to the decision-maker and would aid transferability to other settings. The results of this study favour a change in policy to extend the room temperature hangtime expiry date. However, because of the study design and the scope of the costing, the magnitude of the savings should be considered with some caution.

**Implications of the study**
The authors encouraged the Hospital Infection Control Practice Advisory Committee to develop comprehensive guidelines for the prevention of intravascular device-related infections specific to epidural catheters. In the interim, the authors recommended that institutions treat pharmacy-prepared opioid, local anaesthetic, and opioid-local anaesthetic mixtures similar to non-lipid-containing parenteral solutions, by changing tubes and epidural solution bags no more frequently than every 72 hours.

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**Other publications of related interest**
Feldman JM, Chapin-Roberts K, Turner J. Do agents used for epidural analgesia have antimicrobial properties? Regional Anesthesia 1994;19:43-7.


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Subject indexing assigned by NLM

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