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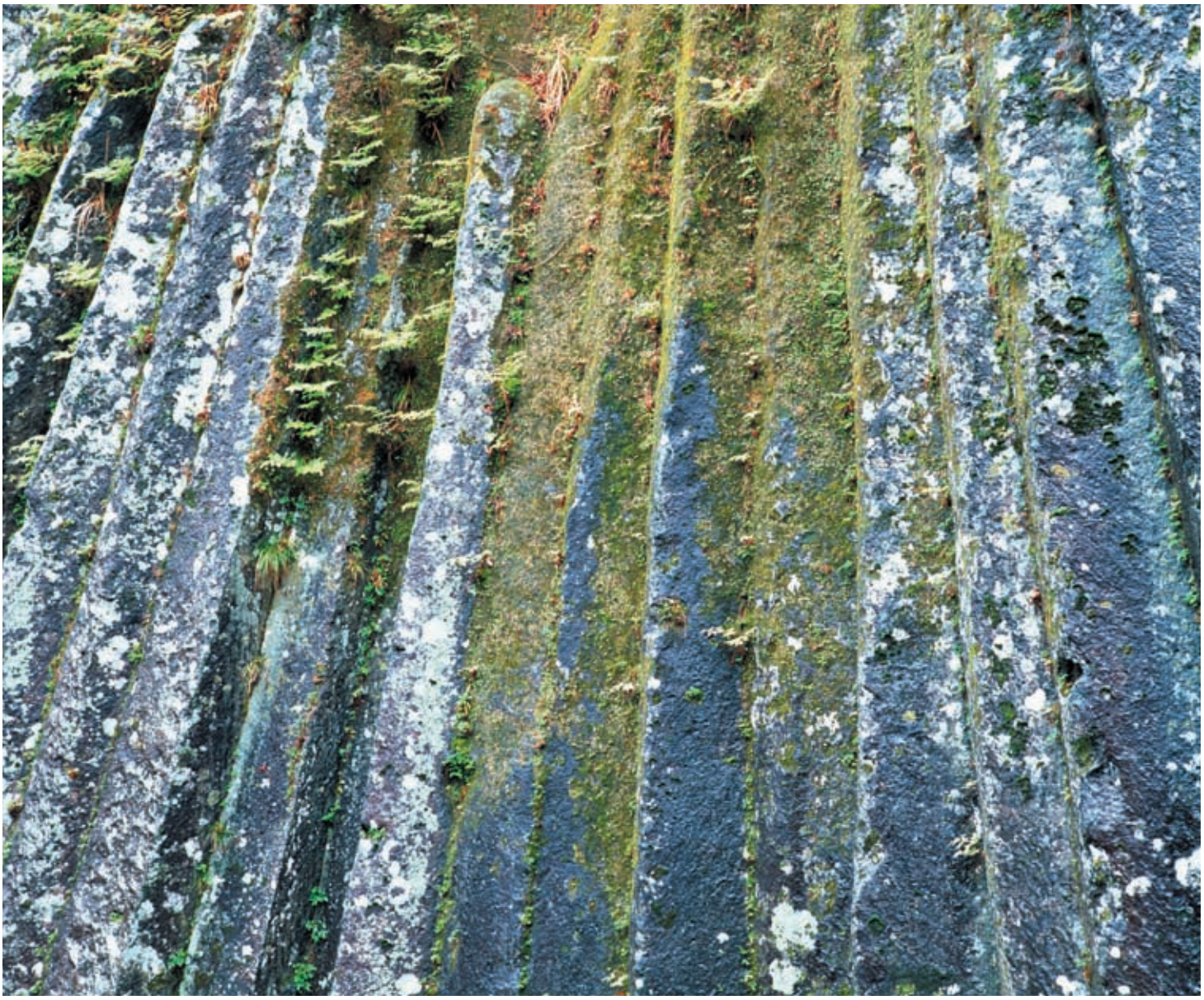

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A Health Technology Assessment – summary

2007

Health Technology Assessment – Projects funded by DACEHTA 2007; 7 (7)

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Health Technology Assessment

COMPUTER-ASSISTED SURGERY IN KNEE SURGERY

– A Health Technology Assessment – Summary

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Summary

Background

The orthopaedic department at Herlev Hospital in Denmark is one of the only departments currently practicing computer-assisted surgery (CAS), where the surgeon has a steering role. The technology makes it possible to increase the precision of the placement of the prosthesis, and thereby reduce the morbidity related to the treatment. An important aspect of CAS and the minimal invasive types of surgery (MIS) is that they can reduce the trauma associated with an operation.

From a health technology assessment (HTA) perspective, computer-assisted surgery is interesting because the technology is rather new in Denmark and not widely used. Furthermore, only one English economic evaluation of CAS is available, which also makes the economic part of the HTA interesting.

The purpose of the present HTA is to investigate the available evidence of the use of CAS in total knee replacement (TKR) and to assess the consequences of CAS for the technology, the patient, the organisation and the economy.

Technology

This chapter consists of a systematic literature review, where the focus is upon the latest and most relevant literature in the area, including evidence related to the area of indication, patient characteristics, safety and effectiveness (operating time, alignment of prosthesis, mobility and blood loss) associated with CAS.

CAS surgery is suitable for patients with a deformed tibia or femur in whom conventional instruments are difficult to use. CAS used for TKR presupposes an adequate mobility in the hip joint. The measure of effective operating time shows that it takes between 10-27 minutes longer to carry out a computer-assisted total knee replacement compared with a traditional knee replacement. An improved learning curve and an improved computer setup may reduce this operating time for CAS. Studies show that CAS provides a more precise and improved alignment of the prosthesis compared with the traditional replacement. In terms of mobility of the knee and blood loss there was little or no difference between CAS and traditional knee replacement.

In terms of safety the review did not find additional complications associated with CAS, and in fact found fewer complications in some cases compared with traditional knee replacement.

Patient

The method used in the investigation of consequences for the patient following CAS was also a systematic literature review. The benefit for the patient is a higher degree of precision in the alignment of the knee prosthesis, eventually fewer complications, and thereby fewer revisions. The available evidence on the patients' satisfaction, experiences and preferences for CAS are limited, which has to be seen in the light that CAS is foremost a tool for the surgeon, rather than a technology in focus for and preferred by the patient. Nevertheless, a few studies have shown increased patient satisfaction and a higher degree of patient preferences for CAS compared with the traditional TKR.

Organisation

The introduction and adoption of the computer-assisted surgery (CAS) used in knee and hip replacement is expected to have both local and national implications, although these are not expected to be large. CAS knee replacement takes longer time with the consequence that fewer knee replacements can be undertaken each day. Furthermore, CAS does not result in any changes in the working procedure and division of labour.

The overall dissemination of CAS-based knee replacements in Denmark should be made with considerations that secure a certain learning curve at each new department. The CAS equipment today is used more in hip replacement than in knee replacement. It is not expected that the CAS procedure will substitute all 5,000 knee operations carried out annually in Denmark, but will be a possibility towards more complicated knees.

Economy

The economic evaluation of CAS-based total knee replacement is carried out as a cost analysis with the use of an earlier published Markov model by Dong et al. (2006).

The costs vary between CAS knee replacement and traditional total knee replacement, which is explained by a higher cost of salary calculated to DKK 2,133 per operation for CAS due to the longer operating time. Furthermore, an extra cost for materials and equipment, calculated at DKK 8,523 per operation, must also be included in the total expense of CAS knee replacement. From these extra costs a limited saving due to fewer complications and revisions with the CAS procedure can be expected.

Dong et al. (2006) is the only existing economic evaluation of CAS in knee replacement identified in the literature review. The present cost analysis shows that CAS will be about DKK 10,000 more expensive compared with the traditional total knee replacement with a 10 year perspective. This is due to higher costs for salary, materials and equipment. A reduction in expenses due to a decreased 10 year revisions rate, has not yet been documented specifically for CAS

Conclusion

The overall conclusion regarding CAS consists of the following points:

1. A conservative analysis shows that CAS is more expensive than a traditionel total knee arthroplasty by aproximately 10.000 d.kr.
2. CAS provides a possibility for a more precise placement of the prosthesis measured on radiographs. There is a clear reduction in outliers
3. Presently, a clear connection between a more precisely placed prosthesis and an improved early range of movement, has not been established.
4. CAS technology is advantageous in patients where traditional instrumentation is not possible due to malalignment in the femur or tibea.

Recommendations and future applications

What are the potential applications in knee arthroplasty for CAS?

- In situations where traditional knee arthroplasties are difficult to perform, due to malalignment.
- In revision surgery.
- CAS provides a possibility to decrease the learning curve when young surgeons are training, compared to traditional knee surgery, due to continuous feedback regarding the balancing.
- CAS is a prerequisite for the further development of MIS technology..
- There is a need for further investigation regarding CAS technology used for knee arthroplasties; as mentioned earlier there is not yet a clear connection between a more precisely placed prosthesis and an improved early range of movement.
- Furthermore, it will also be necessary to explore the revision rate for CAS further than 10 years, because the use of CAS is expected to diminish the revision rate long term, compared with traditional knee arthroplasties.

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