

This is an author produced version of a paper published in Resuscitation. This paper has been peer-reviewed but does not include the final publisher proof-corrections or journal pagination.

Citation for the published paper:  
Englund, Elisabet and Kongstad, Poul C  
"Active compression-decompression CPR necessitates follow-up post mortem."  
Resuscitation. 2006 Jan;68(1):161-2.  
<http://dx.doi.org/10.1016/j.resuscitation.2005.05.022>

Access to the published version may require journal subscription.  
Published with permission from: Elsevier

**Active compression-decompression CPR necessitates  
follow-up post mortem.**

**Elisabet Englund, MD, PhD and Poul C Kongstad, MD**

Department of Pathology, University Hospital of Lund and

Department of Prehospital Emergency Care in Region of Skane

Sweden

**Correspondence:** Elisabet Englund, Dept of Pathology, University Hospital, S-  
221 85 Lund, Sweden. E-mail: [elisabet.englund@skane.se](mailto:elisabet.englund@skane.se)

## **Active compression-decompression CPR necessitates follow-up post mortem.**

**Elisabet Englund, MD, PhD and Poul C Kongstad, MD**

**Elisabet Englund, MD, PhD and Poul C Kongstad, MD**

Department of Pathology, University Hospital of Lund and  
Department of Prehospital Emergency Care in Region of Skane  
Sweden

Sir, with this letter we want to bring into focus the findings of atypical **special** pathological tissue damage seen in some patients not surviving cardiopulmonary resuscitation with active mechanical compression-decompression, ACD-CPR.

In the south of Sweden, an ACD-CPR the commercial device LUCAS®, [1] (Steen et al 2021) was introduced in a prehospital setting from year 2004/2003, with the aim to improve CPR activity in the ambulance service and consequently to ameliorate the results from prehospital CPR. The overall results have been encouraging for continuation so far. With this device, it has proven possible to successfully resuscitate a large number of individuals with cardiac arrest. It has also been made possible to prolong efficient CPR during prehospital transportation, an activity phase often difficult to manage [2]. ( Stapleton, JEMS 912). ACD-CPR with LUCAS® also allowed for simultaneous percutaneous cardiacorony intervention.

*Ja Trygve har mailat dig resultatet*

The ADCACD-CPR system LUCAS® has now been installed in most many of the 50 ambulances in the county county of Skane in southern Sweden - the aim being to apply it as a standard CPR requisite in the region.

The physiological effects and possible pathophysiological consequences of the new method have however not been fully evaluated in humans.

From 2004 and on, technicians and physicians at the Department of Pathology, University Hospital in Lund, were brought to the attention by the autopsy technicians on a combinations of tissue damage not previously seencountered in Lund in deceased patients ppost CPR. Most frequently, costal, parasternal and sternal fractures were seen. These fractures were often multiple, in a number exceeding that seen by us previously in Lund in deceased patients after manual CPR. In some cases, there were werea retrosternal and also mediastinal haemorrhages, in a few of these, the haemorrhage judged to amount to 3200 ml or more. In a few cases, an atypical rupture of the ascending aorta was found and in one case, there was extensive haemorrhage within the ventral myocardium.

There were some a few infradiafragmatic injuries as well: a ruptured aneurysm of the abdominal aorta and liver haemorrhage. These injuries were hypothesized to emanate from sliding of the device; sliding however has not been clearly reported in any caseto occur, a known and feared complication in the use of ACD-CPR (ref?) .

Most of these injuries have previously been reported at autopsy of deceased, who did not survive conventional manual CPR [3]. (3). According to the most extensive report from regular autopsy focused on CPR complications [4], (4), however, the number of injuries in deceased patients post ACD-CPR markedly exceeded those injuries previously seen in patients not surviving conventional/manual CPR. **Nja –det har vi inga direkta rapporter eller belägg för, dessutom markerar teamen med tusch var den skall sitta och är observanta på detta, och har varit sen studierna startade.**

We did not seek patophysiological causal explanations for the lethal outcome in each patient with injuries noted post mortem, but considered it adequate to relate the damage to the CPR, which furthermore had been ongoing for considerably longer time and more fiercely and efficiently than previously did the conventional CPR treatment.

During 15 months from January 2004 until the end of March 2005, we could identify 22 deceased post-CPR patients with unusual injuries, considered to range from mild to severe. In all these patients, ACD-CPR with LUCAS® had been used. In one case, the injury found was minor, compatible with those often encountered after manual CPR. **Du får totalantalet som vi hjärtstopp av Pelle Nilsson, Kamber, vilket kanske bör vara med för att man skall kunna relatera till om det är vanligt eller ej!**

Because the **methods** of the pathologists were not initially focused towards particular damage in relation to CPR, why we suspect that we have considerably underestimated of such tissue damage, especially during 2004. Indeed, while 11 cases were found during that year, there were 11 cases observed already during the first 3 months of year 2005. We do not claim that the injuries precipitated death in these cases, but one should perhaps not rule out the possibility of an influence on the post CPR outcome in some of these patients.

These preliminary findings points towards the necessity of post mortem follow-up and mapping of injuries in all patients dying after not surviving CPR of any type. There is a need for systematic reports on complications, as pointed out by Hoke and Chamberlain [3]. (ref 2003).

We want to emphasize that the use of ACD-CPR must be reported, whether the patient succumbs from the original disease/circulatory arrest, from the progressive events during CPR, or also in the situation when a patient dies from other, intercurrent causes. Such reporting not only helps to urge the pathologist to look for injuries and evaluate their possible association with the CPR, but also enables the clinician to modify the treatment and use of methods used for CPR as well as development of CPR equipment..

**Det är svårt tycker jag att vid ett tillstånd som obehandlat leder till döden och som har upp mot 95% prehospital mortalitet tala om att ACD-CPR ansvarar för dödsfallet!**

**Acknowledgements:** autopsy technicians Leif Olofsson and Lars Olofsson, dr. Charles Walther, MD, all at the Dept of Pathology as above..

#### **Conflict of interest statement**

None.

#### **References:**

- 1: Steen S, Liao Q, Pierre L, Paskevicius A, Sjöberg T. Evaluation of LUCAS, a new device for automatic mechanical compression and active decompression resuscitation. *Resuscitation* 2002;55(3): 285-99.
- 2: Stapleton ER. Comparing CPR during ambulance transport. Manual vs. mechanical methods. *JEMS* 1991 Sep;16 (9):63-4, 66, 68 passim.

3: Hoke RS and Chamberlain D, Skeletal chest injuries secondary to cardiopulmonary resuscitation. Resuscitation 2004;63: 327-38.

4: Baubin M, Sumann G, Rabl W et al. Increased frequency of thorax injuries with ACD-CPR. Resuscitation 1999;41:33-8.

To the Editorial Office  
Resuscitation  
Health Sciences, Elsevier  
Oxford UK  
Fax +44 (0) 1865 843992

Lund April 19<sup>th</sup> , 2005

To the Editor,

This is a covering letter regarding the electronically submitted manuscript  
RESUS/2005/000097:  
“Active compression-decompression CPR necessitates follow-up post mortem”,  
by E. Englund and PC Kongstad.

We have written it with the intention of submission as a Letter to the Editor, but leave the  
decision to the Editor about its form, if accepted for publication.

On behalf of the two authors, I confirm that both authors are responsible for and contributing  
to the text, both also authorizing the submission to Resuscitation.

Sincerely,

Dr. Elisabet Englund, associate professor  
Department of Pathology  
University Hospital  
Lund, Sweden