# Survivals in pediatric cardiac tamponade caused by central venous catheters

Pediatric central venous catheter (CVC) placement is used for fluid or drug administration and is useful for hemodynamic (the fluid dynamics of flow) management in cardiac surgery but associated with complications such as rare but serious cardiac tamponade (hindering normal cardiac activity usually surrounded by blood). This review aimed to identify risk factors for death in cardiac tamponade.

Published articles on pediatric CVC-associated cardiac tamponade were obtained by searching PubMed (comprising over 25 million citations for biomedical literature) and Google and retrospectively reviewed to analyze risk factors for death. Factors examined for their effect on mortality risk included patient age, weight, CVC size, days from CVC insertion to tamponade occurrence, substances administered, insertion site, treatment, CVC material, and initial CVC tip position. Multiple regression analysis was performed to identify independent predictors of survival. The *p* values less than 0.05 were considered significant.

Sixty-two articles published between 1971 and 2014 were found, reporting 110 pediatric CVC-related cardiac tamponade cases in 89 neonates (1 to 31 days), 11 infants (1 to 12 months), 7 children (1 to 15 years), and 3 patients with no age given. Of 110 patients reported in 62 articles, 69 survived and 41 died. Among survivals, 55 of 69 patients were treated; among deaths, only 7 of 38 (odds ratio of 538, 95% confidence interval of 29–9877, *p* less than 0.0001). Multiple regression analysis in 44 cases showed that treatment (p less than 0.0001) and initial CVC tip position (p = 0.020) were independent predictive factors related to improve cardiac tamponade survival.

Past studies have mainly discussed how to avoid pediatric cardiac tamponade; by contrast, the present study focused on how to avoid deaths. The present study included all the articles reviewed in two studies and added others for a total of 62 articles and a death-report rate of 37% (41/110); after year 2000, the death-report rate decreased to 27% (21/79). In the present study, median patient weight and number of days from insertion to diagnosis were similar between survivals (median weight 1.2 kg and 4 days) and deaths (median 1.5 kg and 4 days). This finding suggests that particular attention should be paid to patients on the fourth day from insertion, regardless of weight. Material did not affect survival rates.

Multiple regression analysis revealed that treatment was a strong independent predictor, and initial CVC tip position a more moderate independent predictor, of survival in pediatric cardiac tamponade. The efficacy of pericardiocentesis (to remove blood surrounding the heart) for pediatric cardiac tamponade has already been indicated. Since a 1982 case report described the use of pericardiocentesis to save a neonate with cardiac tamponade, timely diagnosis and therapeutic interventions such as pericardiocentesis, pericardial drainage, and CVC removal have improved survival among neonates and infants with the condition. Cardiac tamponade should be strongly

suspected in any child with a peripherally or centrally inserted CVC who develops sudden or acute cardiopulmonary deterioration, even when the catheter is appropriately placed. When deterioration is observed after a CVC is inserted, the CVC should be removed, and the patient treated as soon as possible.

Publication bias (for example; statistically significant results have been more likely to be published) is present in the present investigation, since uncomplicated cardiac tamponade with good outcome would be less frequently reported in indexed journals. Comprehensive information on factors that might have influenced cardiac tamponade mortality could not be obtained, as some were missing from the reviewed articles.

These results suggest that cardiac tamponade survival might be better when tamponade is detected early and treated promptly, and may be further improved when tip position is extracardiac.

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## Publication

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