

## Roller Pump-Induced Tubing Rupture during Cardiopulmonary Bypass

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**Abstract :** We analyzed the effects of variations in the diameter of silicone rubber and polyvinyl chloride (PVC) tubings on the likelihood of tubing rupture during modeling of accidental arterial line clamping in cardiopulmonary bypass with a roller pump. A closed CPB circuit constructed with a roller pump was tested with both PVC and silicone rubber tubings of 1/2, 3/8, and 1/4 inch internal diameter. Arterial line pressure was monitored, and an occlusive clamp was placed across the tubing distal to the pressure monitor site to model an accidental arterial line occlusion. A CCD camera with 512(H) x 492(V) pixels was installed above the roller pump to measure tubing diameters at pump outlet, where the maximum deformations (distension) of the tubings occurred. Quantitative measurement of the changes of tubing diameters with the change of arterial line pressure was performed using computerized image processing techniques. A visible change of tubing diameter was generally noticeable by around 250 psi of arterial line pressure, which was already very high. By 1500 psi, the PVC tubings showed an increase of diameter of between 5-10 %, while the silicone rubber tubings showed an increase between 20-25 %. Silicone rubber tubings of all sizes showed greater distensibility than PVC tubings of equivalent size. In conclusion, although roller-pump induced tubing rupture remains a theoretical problem during cardiopulmonary bypass in terms of the inherent mechanism of the pump, in reality such an occurrence is impossible in real clinical conditions.

**Keywords :** roller pump, tubing rupture, cardiopulmonary bypass, arterial line

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