Ablation techniques adapted for low- and middle-income countries

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Cervical cancer is a leading cause of cancer-related mortality among women in low- and middle-income countries (LMICs). The World Health Organization recently released guidelines that endorse alternatives to cytology-based screening that will facilitate increased screening coverage and detection of curable cervical cancer precursors. In order to reduce the cancer burden, highly effective screening strategies must be combined with accessible and affordable treatment of cervical intraepithelial neoplasia (CIN). Two point-of-care technologies with the potential to address this treatment gap are the LMIC-adapted CryoPen® Cryosurgical System, with a probe temperature of approximately -60ºC, and the thermocoagulator, with a probe temperature of 100-120ºC, to induce cellular destruction. Since there is scant data on the extent of CIN involvement in an underscreened population, determining mean lesion depth will establish the minimal depth of necrosis (DON) that ablative techniques need to achieve to eradicate CIN. The study aimed to establish the maximum depth of involvement of CIN3 and test whether the adapted CryoPen® and thermocoagulator reach the DON established as necessary for eradicating CIN3. A convenience sample of 107 cases of CIN3 diagnosed on cold knife cone biopsy were reviewed by a local pathologist at the National Cancer Institute (INEN) of Peru and a U.S. pathologist. Mean depth of involvement was measured in the CIN3 cases and mean DON was measured in the ablated cervical specimens. Ten women undergoing hysterectomy for reasons other than cervical cancer or precancer underwent one of two ablative techniques 12-24 hours prior to surgery at INEN: a single five-minute freeze with the CryoPen® (n=5) or a single 60-second, 100ºC application of the thermocoagulator (n=5). Following the hysterectomy, the cervix was separated from the uterus and the anterior and posterior lips were separated and processed. The local pathologist, who was blinded to which ablative technique was used, measured maximum DON in both lips. Mean depth of CIN3 involvement was 2.0mm among 107 cases; 79.4% of cases had a mean depth ≤3.0mm, 89.7% had a mean depth ≤3.5mm, 93.5% had a mean depth ≤4.0mm, and 6.5% had a mean depth ≥5.0mm. The maximum DON achieved by the LMIC-adapted CryoPen® was ≥3.0 in 80% of cases, ≥3.5mm in 80%, ≥4.0mm in 80%, ≥4.5mm in 40%, and ≥5.0mm in 20%. The maximum DON achieved by the thermocoagulator was ≥3.0mm in 80% of cases, ≥3.5mm in 80%, ≥4.0mm in 20%, and ≥4.5mm in 20%. The CryoPen® achieved a mean DON of 4.12mm in the anterior lip (range 1.5 - 4.5mm) and 4.08mm in the posterior lip (range 2.8 - 6.0mm). The thermocoagulator achieved a mean DON of 3.54mm in the anterior lip (range 2.2 - 4.5mm) and 3.02mm in the posterior lip (2.0 - 4.1mm). The pathology review of CIN3 cases showed that 90% of CIN3 would be eradicated if DON reached at least 3.5mm. The mean DON of both the LMIC-adapted CryoPen® and thermocoagulator exceeded 3.5mm. Attempts to improve the range of depths and overall efficacy will be emphasized through ongoing refinement of the devices and remedial training of clinicians providing the treatments.