Can bank erosion of streams be stopped?

Bank erosion is a serious problem in many rivers. Generally occurring during the monsoon season, when the rivers are in spate, bank erosion causes inconceivable damage to human habitation and property. Usually, masonry structures are constructed and boulders laid on the eroding banks to stop caving. These measures are generally of temporary help only. Erosion and caving recur, often in higher magnitude after each monsoon.

A close look at the problem shows that bank erosions are restricted to the inner concave banks of meandering streams (Figure 1 *a*). A natural stream pattern is seldom straight. Whenever the flow velocity in a straight stream channel exceeds a certain limit, the bottom layer of water develops a sinuous pattern, while the upper layer moves faster without any sinuosity[1].

Several strong natural forces come into play as a stream channel meanders. Centrifugal force operating at the meander curvature impinges the fast-moving upper layer of water on the inner concave bank, initiating erosion. Flow separation and super elevation of the water surface at the river bend also enhance bank erosion[2].

As the impinging surface water plunges downwards at the concave bank, some water from the bottom emerges on the opposite side (the convex bank) to maintain continuity. The net effect is a circulatory, helical flow[3]. Caught up in the helix, sediments eroded-off the concave bank are carried across the streambed to the opposite bank to be eventually deposited there as point bars (Figure 1 *b*). Erosion of the inner concave bank and deposition on the convex bank go on simultaneously in all meandering streams. This basic mechanism is responsible for erosion of human settlements on concave banks of rivers and development of new, fertile bars (point bars) on the opposite sides. No artificial construction is capable of counteracting this strong natural force.

Many human settlements located on concave banks of the Padma River, Bangladesh, disappeared due to bank erosion. In India, incidents of bank caving are common features in the Bhagirathi River, North Bengal and many other rivers. Artificial constructions along riverbanks have been or little help in these places. To appreciate how futile such attempts are, one has to look into the Himalayan rivers flowing through deep, mountainous gorges. Erosion of the inner concave banks and simultaneous deposition of sediments on the opposite sides are common features in these streams, lined by rocks.

The only solution to the problem therefore, is to keep away from the concave banks of rivers. Human habitations should be restricted to the convex banks. Settlements should maintain safe distances from the river channels, keeping in mind that a river channel is likely to shift laterally periodically. The deepest part of the channel (called the thalweg) also changes its position in space. Therefore, as an additional protective measure, it is advisable to construct embankments between the river channel and human settlements[4] (Figure 1 *c*).

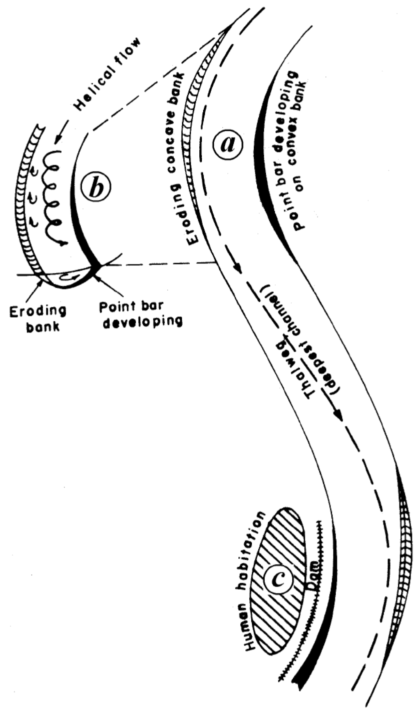

Figure 1. A typical meandering stream (schematic).

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Uterine cervical cancer – Prevention and control

Cervical cancer is the most common cause of cancer deaths in the developing countries, despite the fact that the disease is preventable. This is second only to breast cancer in most cancer registries in India. Signs and symptoms before the development of cervical cancer are not noticeable among women. The abnormal areas can be found through a screening or examination of the uterine cervix. Screening involves testing of target groups who are at risk for the disease. Women, between 30 and 60 years of age, are at the highest risk of cervical cancer and should be screened. Various screening tests are available. Alternatives to cervical cytology screening explored recently are aided visual and Human Papillomavirus (HPV) screening. The HPV status is used to identify women at ‘high risk HPV-type 16 and 18’, which is now considered as a main causative agent for developing uterine cervical cancer. The currently available Hybrid Capture II (HCII) method of DNA-based HPV screening is expensive and requires a relatively sophisticated laboratory infrastructure. This may not

Table 1. Pooled test characteristics of different modalities of cervix cancer screening from Indian studies

Screening test	Participants (sites)	Sensitivity (%) (range)	Specificity (%) (range)
Cytology	22,633 (05)	58 (29–77)	95 (89–99)
HPV	18,065 (04)	67 (46–81)	94 (92–95)
VIA	54,981 (11)	77 (58–94)	86 (75–94)
VIAM	16,900 (03)	64 (61–71)	87 (83–90)
VILI	49,080 (10)	92 (76–97)	85 (73–91)
VIA (+) or VILI (+)	49,080 (10)	94	81
VIA (+) and VILI (+)	49,080 (10)	79	89

Source: R. Sankaranarayana *et al.*[3–5].

be feasible for mass screening in low resource settings. The aided visual methods are known as: VIA (visual inspection of cervix after application of acetic acid), VIA with magnification (VIAM) and VILI (visual inspection of cervix after application of Lugol's Iodine). VIA and VILI are two kinds of visual tests presently feasible in low resource settings to identify precancerous lesions in women up to the age of 50 years. However, standardization of definitions for positive and negative tests is essential and needs special attention for regular and consistent quality assurance.

HPV vaccine trials are in progress in some parts of the world to evaluate the efficacy in prevention of the cervical cancer. Long-term efficacy and effectiveness of HPV vaccine is considered as the only opportunity for global control of cervical cancer. The HPV vaccine is believed to have a great promise for the control of cervical cancer, especially in the developing countries[1]. The Institute of Cytology and Preventive Oncology, of the Indian Council of Medical Research is initiating vaccine trials and is in the process of developing a low-cost DNA vaccine against HPV for use in the prevention of HPV-associated cancer. However, the strategies on HPV vaccine implementation need special consideration. Besides vaccine delivery, vaccine implementation would include public awareness about HPV, de-stigmatizing the HPV infection, and gaining acceptance for mass vaccination of pre-adolescents and adolescents, possibly from both sexes before their sexual debut[2]. In the mean time, the various preventive strategies that are promising need to be endorsed.

The aided visual and HPV screening as an alternative to cytology-based cervical screening demonstrated acceptable performance in the field settings, as shown from pooled data[3–5] on cervical cancer screening of various modalities from Indian studies (Table 1). The accuracy of the screening test was assessed through inherent characteristics of the tests called sensitivity and specificity. Sensitivity is the proportion of women with actual disease who test positive. Specificity is the proportion of women without actual disease who test negative. Table 1 shows that, the VIA and VILI tests used in parallel with 94% sensitivity and 81% specificity appear to be a good test combination for screening. Presently, the aided visual methods of screening are acceptable, simple and low-cost, promising alternatives. This screening could be performed even by paramedical personnel; it has demonstrated good yield in the detection of cases. These tests are applicable in a wide range of settings, but are not recommended for use in post-menopausal women. A model district cancer control programme initiated by the Tata Memorial Centre, Mumbai included aided visual screening methods for cervical cancer control. Healthcare providers at different levels in developing countries, especially female medical and paramedical personnel can be made aware through a short training programme and they can make use of the simple visual techniques to control the disease.

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