See-and-treat strategy for diagnosis and management of cervical squamous intraepithelial lesions

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In a see-and-treat protocol, patients referred for colposcopy because of an abnormal Pap smear in cervical-cancer screening can be treated by loop excision, without biopsy, during one visit to the clinic. However, overtreatment in the see-and-treat strategy has been reported to be 1·2–83·3% for low-grade squamous intraepithelial lesions (SIL) and to be 13·3–83·3% for high-grade SIL. Range of overtreatment narrowed to 4·0–23·5% for those with normal pathology and to 18·0–29·4% for those with normal or low-grade pathology when calculation of overtreatment was restricted to patients diagnosed with high-grade SIL on colposcopy and referral Pap smear. Most common treatment complications are bleeding and infection. Nonetheless, the strategy has become accepted internationally: low costs, decreased patient anxiety, and increased compliance make it appealing, especially in settings with limited health resources, and for patients at risk of not being treated in a timely manner or of not returning for a second appointment. Mathematical modelling may give information about the appropriateness and usefulness of this treatment while the results of long-term clinical trials are awaited.

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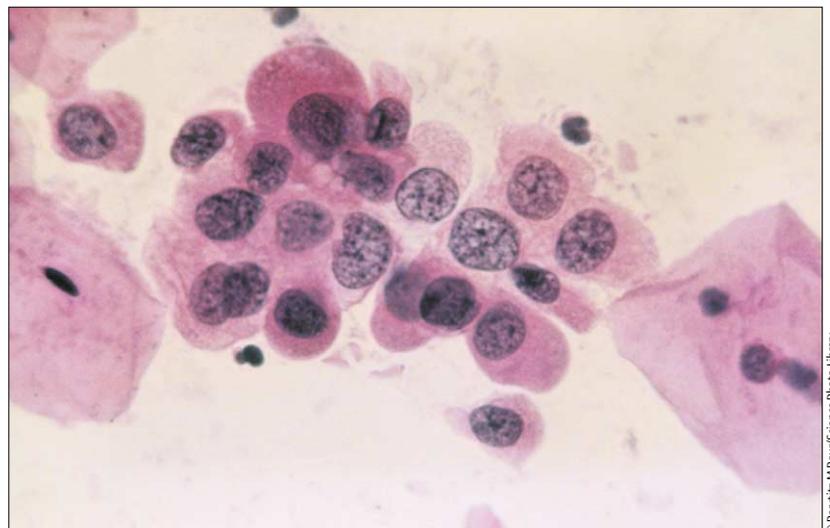sbcantor@mdanderson.org

The see-and-treat strategy was developed to offer patients who had an abnormal Pap smear (figure 1) the opportunity to be diagnosed and treated during one visit to the clinic. The see-and-treat regimen is a variant of usual care that begins with a diagnostic visit, during which colposcopy is done. If squamous intraepithelial lesions (SIL) are seen at that time, a biopsy (or series of biopsies) is done to confirm the colposcopic impression (figure 2). Biopsy results are available in 2–3 weeks. In some health-care institutions the patient must return to the care setting to discuss the histological findings, during which the physician discusses the importance of the findings, and describes treatment options and their potential risks and benefits. If histological results indicate high-grade SIL (or low-grade SIL in some clinical settings), a further appointment is scheduled for outpatient treatment about 2 weeks later.

With see-and-treat strategy, patients with an abnormal Pap smear receive a colposcopic assessment to decide whether the findings warrant treatment and, if so, it is given during the same session. Treatment decisions are based mainly on colposcopic assessment and on results of Pap smear; previous biopsy is not needed for treatment decisions. Here, we review the development and application of the see-and-treat strategy with the aim of understanding the issues involved in this clinical management plan.

Advantages and disadvantages

The see-and-treat strategy is considered as a serious alternative treatment in specific circumstances when compliance of patients,[1,2] treatment costs,[3–5] and anxiety by patients[6] might interfere with the effectiveness of treatment. In particular, the strategy may be recommended when the patient is unlikely to return for follow-up care, as might occur in urban and poor populations and especially in view of time lags before a colposcopy appointment is scheduled. The patient's anxiety may be relieved by assurance from the physician

that the lesion has been found and destroyed completely, and will be assessed histologically.[6] In surveys based on confidential questionnaires[7–9] patients' satisfaction with the see-and-treat strategy was shown to be acceptable.

See-and-treat also defines the true diagnosis. In usual care, the severity of the cervical lesion may be underestimated by punch biopsy. By contrast, histological assays from definitive treatment, such as loop electrosurgical excision procedure (LEEP), commonly show a more advanced stage of cervical intraepithelial neoplasia (CIN, figure 1) than do punch-biopsy samples.[10–12] Although punch biopsy should sample the most severe part of the lesion, this detection is commonly not so because an excision sample is always larger than that of punch biopsy and thus is better sample for histological analysis. Benedet and colleagues[13] found 86·8% agreement between the results of colposcopic diagnosis and those of accompanying directed biopsies, which suggested that the quality of

Figure 1: Light micrograph of cervical smear showing CIN3 dysplasia

Figure 2: Colposcopic view of high-grade SIL

colposcopic practice should be improved by setting appropriate standards, such as a threshold for agreement between colposcopic impression and histological diagnosis.

However, the see-and-treat strategy has several disadvantages, most important of which is the possibility of overtreatment. The effectiveness of see-and-treat depends on accurate colposcopy, and most studies have found colposcopy to be reasonably accurate compared with cervical pathological diagnosis.[14] However, interobserver variation in interpretation of colposcopic images[15] is the reason that, in usual care, colposcopically directed biopsy follows an unfavorable colposcopic finding. The imprecision of colposcopy is also a crucial concern with the see-and-treat strategy. A meta-analysis[16] of diagnostic colposcopy found that the average weighted sensitivity of colposcopy for the threshold healthy cervix compared with all cervical abnormalities (ie, atypia, low-grade SIL, high-grade SIL, and cancer) was 96%. For threshold between the categories healthy cervix and low-grade SIL compared with high-grade SIL and cancer, average weighted sensitivity was 85%. Thus, with high sensitivity but only fair specificity, colposcopy leads to substantial overcalling and possibly, with the see-and-treat strategy, to overtreatment. Therefore, patients with lower-grade lesions (eg, low-grade SIL, atypical squamous cells of unknown importance, and infection with reactive repair) or with a healthy cervix may receive inappropriate and excessive treatment, and may be unnecessarily exposed to bleeding and infection—the most common complications of this procedure.[17] Moreover, from an economic perspective, overtreatment is a waste of resources that warrants evaluation.

Overtreatment can be defined in two ways, depending on a conservative approach or a more aggressive approach to treatment of SIL. A conservative approach, as recommended by the US National Cancer Institute in a guideline developed with support of the American

Society of Colposcopy and Cervical Pathology,[18] defines the appropriate treatment threshold as a diagnosis of high-grade SIL or worse, and states the numerator as the number of patients who were treated and found to have normal or low-grade SIL at histological analysis. Thus, this approach will yield more patients who were overtreated at the time of the diagnostic visit. In most studies of a see-and-treat strategy, the nomenclature of the US National Cancer Institute is replaced by the terms moderate or severe dysplasia, CIN2, or CIN3 to describe cervical SIL that needs treatment (figure 1). The more aggressive approach calls for treatment when histological analyses indicate low-grade SIL or worse, as recommended by the *Standards and Quality in Colposcopy* published in 1996 by the UK National Health Service Cervical Screening Programme in collaboration with the British Society for Colposcopy and Cervical Pathology.[19] With this approach, the numerator for overtreatment is the number of patients treated and found to have no SIL, only normal histological results.

The controversy of the see-and-treat approach is based partly on the fact that colposcopy is not a perfect diagnostic test: even when a clinician diagnoses high-grade SIL by colposcopy, the existence of lesions cannot be known with certainty until they are confirmed by histological biopsy or excision. Thus, treatment on the basis of colposcopy is done with less than 100% certainty of its need. Based on assumptions of the threshold model for medical decision-making,[20] this course of action is acceptable and appropriate. Yet the question remains: if treatment is appropriate based on a less than certain chance that the patient has high-grade SIL, what is the lowest probability that the patient does have high-grade SIL that make a see-and-treat protocol acceptable? The problem is especially complicated because SIL can regress, persist, or progress and whether a patient will comply with future screening, diagnostic, or treatment visits is not known. Compliance rates for treatment of SIL with usual care range widely, 30–73%, according to the setting of the study (eg, in a developing country *vs* an inner-city population).[2,21]

A further concern is the time needed for informed-consent in a see-and-treat setting, and the counseling of patients about the benefits and risks.[22] Development of an educational programme to give women information about treatment options for abnormal Pap smear before their visit to the colposcopy clinic may be helpful.[9]

History of see-and-treat strategy

The development of this strategy is linked to knowledge of the natural history of the disease and the availability of tools for effective treatment. To date, dysplasias are known to represent a range of neoplasms, from changes induced by infection with human papillomavirus to in-situ carcinoma.

Clinicians began to consider the see-and-treat strategy after general acceptance that dysplasia is the precursor

of in-situ carcinoma and that local treatment of the cervix is appropriate after invasive disease has been ruled out. The strategy became especially appealing when clinicians recognised that the natural history of the disease is less aggressive than other cancers: intraepithelial lesions tend to persist and regress rather than progress toward invasive disease.

Thus, the focus became use of the colposcope as a secondary tool after use of the primary tool, the Pap smear, to detect and grade preinvasive lesions, and the use of less-invasive procedures for treatment of outpatients who had precursors of cervical cancer. For patients with intraepithelial lesions, ablation of the transformation zone is considered appropriate treatment after invasive disease has been ruled out and see-and-treat arose from the effectiveness of this method of outpatient treatment.

Although they did not follow a see-and-treat strategy, Prendiville and co-workers[23] used biopsy samples to classify the severity of intraepithelial lesions and were the first to propose the ablation of cervical lesions in an outpatient setting. They reported on the use of large loop excision on the transformation zone (LLETZ) by use of see-and-treat with 66 patients; however, results were not categorised by treatment modality because the aim was to define the benefits of LLETZ as an outpatient procedure, rather than the feasibility of treatment during a single visit.

Outpatient treatment for high-grade SIL

The accepted method of treatment for high-grade SIL is either ablation or excision. Ablation is done by use of electrocautery, cryosurgery, or laser surgery.[24] Electrocautery was first used in 1968 by Richart and Sciarra,[25] who reported on a series of patients treated with electrocoagulation 2 weeks after colposcopy and punch biopsy. Cryosurgery was first used in 1972 by Crisp,[26] and later in that year by Tredway,[27] to treat outpatients, and has been well accepted since then for treatment of cervical intraepithelial lesions. Laser therapy was introduced in 1977 by Stalf and co-workers[28] and in 1978 by Carter and colleagues;[29] both studies, used the carbon-dioxide laser method to treat outpatients without anaesthesia. However, the laser procedure is time-consuming and costly and is not preferred by many colposcopy clinics.

Excision is done by use of traditional cold-knife cone biopsy or by a form of electrosurgery (ie, LEEP, LLETZ, and electrosurgical loop excision of the cervical transformation zone, ELECTZ). LEEP-cone is a further procedure, which resembles the cold-knife cone and, as well as LEEP, is an outpatient procedure done under local anaesthesia in clinics and physicians' offices for patients with abnormal colposcopy. Gynaecologists and family practitioners may use this treatment modality, but need training in colposcopy and cervical surgery.

LEEP, introduced by Boulanger and colleagues[30] and Prendiville and co-workers[23] in 1989, was based on the series reported in 1981 by Cartier and co-workers,[31] who described use of diathermy as a feasible technique to obtain cervical samples. Boulanger and colleagues[30] compared electroconisation with carbon-dioxide laser conisation and with scalpel excision. Prendiville and co-workers[23] also described the LLETZ procedure, which allowed wider, deeper excision of the transformation zone with the benefit of being able to use removed tissue for histological analysis. LEEP has proved to be a simpler and easier procedure than other treatments, and several studies have reported low morbidity.[2,8,32] The most common complications associated with this procedure are vaginal discharge, secondary vaginal haemorrhage, infection, and cervical stenosis.

Clinical trials of see-and-treat

In 1990, Bigrigg and colleagues[7] first described a see-and-treat strategy by use of a low-voltage diathermy loop given in one visit (table 1). Patients were referred to the colposcopy clinic because of abnormal smears, and received LLETZ as outpatients under local anaesthesia in one visit. Reported overtreatment was 27·9% if the threshold was a pathology report of low-grade SIL or negative result, and 4·7% if the pathology report was negative. Keijser and co-workers[33] treated patients diagnosed with any grade of CIN and reported overtreatment of 13·3% for low-grade SIL or negative result and of 7·0% for a negative pathology report. The researchers described cervical stenosis and infertility as complications associated with the procedure (table 2). Hallam and colleagues[8] did a prospective study of 1000 patients referred to a clinic because of abnormal Pap smear. Patients received diagnostic colposcopy, and LLETZ was done if CIN was reported. Notably, 109 patients received a LLETZ-cone in a see-and-treat procedure. Inclusion of the LLETZ-cone meant the researchers expanded the options for use of this treatment strategy to patients who had unsatisfactory colposcopic results or suspicion of invasion.

Hallam and colleagues[8] reported overtreatment of 27·3% for patients with histological reports of CIN1 or less, and of only 1·9% for patients with pathological reports of healthy cervix or inflammatory disease. In a prospective trial of 139 participants with diskaryotic cervical smears, Brady and colleagues[34] reported overtreatment of 39·6% for patients with low-grade SIL and healthy histological samples. Chia and colleagues[35] reported 30% overtreatment for patients with healthy cervix or low-grade SIL from pathology reports in a trial of 327 participants.

There is substantial variation in overtreatment with the see-and-treat approach (table 1), which ranged from 1·2% to 83·3% for patients with normal pathology, and from 13·3% to 83·3% for those with normal or low-

Country	Patients	Reason for referral	Threshold for treatment decision	Overtreated patients who had normal or inflammatory pathology	Overtreated patients who had normal or low-grade SIL	Failures at follow-up (patients)*	Ref
India	18	Cervical screening	Colposcopy showed any CIN Colposcopy showed high-grade SIL Colposcopy showed low-grade SIL	11 of 18 (61·1%) 1 of 5 (20·0%) 10 of 12 (83·3%)	13 of 18 (72·2%) 2 of 5 (40·0%) NA	Not reported	1
Peru	149	Pap indicative of CIN	Colposcopy showed any CIN	NA	64 of 149 (42·9%)	Any CIN (7 of 149, 4·7%) at mean follow-up of 335 days	2
UK	981	Diskaryotic smear, any grade	Colposcopy showed high-grade SIL	47 of 981 (4·7%) high-grade SIL	274 of 981 (27·9%)	Repeated smear at 4th month was abnormal (41 of 969, 4·1%)	7
UK	1000	Diskaryotic smear, any grade	Colposcopy showed any CIN	19 of 999 (1·9%)	273 of 999 (27·3%)	Evidence of diskaryosis at mean follow-up of 23 months (86 of 967, 8·9%)	8
			Mild diskaryotic smear or higher	Colposcopy showed any CIN	11 of 897 (1·2%)	197 of 897 (21·9%)	Diskaryosis in patients with complete excision of lesion (48 of 629, 7·6%) Diskaryosis in patients with incomplete excision of lesion (32 of 250, 12·8%)	
UK	118	Abnormal Pap smear	Colposcopy showed any CIN	5 of 118 (4·2%)	53 of 118 (44·9%)	No evidence of recurrence, although follow-up time not specified	9
			Colposcopy showed high-grade SIL	10·0% (raw data not presented)	NA		
USA	47	Abnormal Pap smear	Colposcopy showed high-grade SIL Pap smear and colposcopy showed high-grade SIL	16 of 47 (34·0%) 14·0% (raw data not presented)	26 of 47 (55·3%) NA	Residual SIL (2 of 29, 6·8%)	32
Netherlands	424	Abnormal Pap smear	Colposcopy showed any CIN	29 of 413 (7·0%)	55 of 413 (13·3%)	Repeated smear within 1 year showed mild or severe dysplasia (110 of 395, 27·8%)	33
UK	139	Diskaryotic smear, any grade	Colposcopy showed high-grade SIL	NA	52 of 131 (39·6%)	Not reported	34
UK	327	Abnormal Pap smear	Colposcopy showed any CIN Pap smear showed moderate or severe diskaryosis and colposcopy showed CIN	103 of 327 (31·4%) 13 of 110 (11·8%)	206 of 327 (62·9%) 33 of 110 (30·0%)	Residual CIN (21 of 221, 9·5%) Residual CIN with incomplete excision of CIN1 (3 of 18, 16·6%) Residual CIN with incomplete excision of CIN3 (14 of 38, 36·8%)	35
Egypt	66	Clinically suspicious cervix	Colposcopy showed high-grade SIL	20 of 66 (30·3%)	55 of 66 (83·3%)	No residual lesions at 3-month follow-up	36
South Africa	33	Pap smear, high-grade SIL	Colposcopy showed high-grade SIL	5 of 32 (15·6%)	7 of 32 (21·8%)	Not reported	37
USA	50	Pap smear, high-grade SIL	Colposcopy showed high-grade SIL	2 of 50 (4·0%)	9 of 50 (18·0%)	No residual disease or recurrences reported after 1 year	38
USA	104	Pap smear, high-grade SIL	Pap smear showed high-grade SIL Colposcopy showed high-grade SIL Colposcopy showed low-grade SIL or less	27 of 104 (25·9%) 8 of 34 (23·5%) 18 of 58 (31·0%)	41 of 104 (39·4%) 10 of 34 (29·4%) 24 of 58 (41·3%)	Not reported	39

NA=not available. *Persistence or recurrence of cervical SIL.

Table 1: See-and-treat clinical trials

grade pathology.[1,8,33,36] Rates of overtreatment could be improved with use of a more restrictive treatment protocol or with specification of subgroups of patients. If the calculation of overtreatment was restricted to patients diagnosed with high-grade SIL on both colposcopic assessment and referral Pap smear, then the range overtreatment narrowed to 4·0%–23·5% for those with normal pathology and to 18·0–29·4% for those with normal or low-grade pathology.

See-and-treat strategy in low-resource settings

Cervical cancer remains one of the most common health problems in developing countries. Every year more than 400 000 women worldwide are found to have this disease.[40] By 2000, the highest burden of the disease was reported in Latin American and African countries, and the highest age-standardised prevalence of cervical cancer were in Haiti (93·85 per 100 000 women) and Tanzania (61·43 per 100 000 women).[41] By contrast, age-standardised prevalence of cervical cancer is 7·84 per 100 000 women in Canada, 8·25 per 100 000 women in the USA, and 9·35 per 100 000 women in the UK.[38]

In developed countries, programmes of large-scale screening by use of Pap smear proved to be important in decreasing the incidence of cervical cancer.[42,43] The effectiveness of these programmes is attributed mainly to early detection of cervical cancer and detection of precancerous lesions, which allow participants to be treated promptly and appropriately, and contribute to increased survival.

A see-and-treat strategy for management of CIN seems to be an appealing treatment option in settings where resources are scarce and access to healthcare is restricted (ie, in developing countries). Physicians in these

countries have noted that treatment participation and compliance could be increased if a one-session treatment was offered. Trials done in urban clinics in Peru,[2] Egypt,[36] and India,[1] and in rural South Africa,[37] are summarised in table 1. The experience of these research groups shows the benefits and difficulties in the implementation of a see-and-treat option in developing countries. In Peru, a comparison by Santos and co-workers[2] favoured LEEP over laser ablation. Darwish and colleagues,[36] who assessed patients during follow-up in Egypt, found that patient satisfaction with the see-and-treat strategy was 89% versus 38% for usual care. Overtreatment was 83% with the threshold of low-grade SIL or less; however overtreatment (with the same threshold) was also high for the usual-care strategy (72%). Kattukaran and colleagues[1] offered Indian participants not only Pap smear screening but also diagnostic colposcopy and treatment in one session if needed (table 1). Overtreatment for patients with colposcopic finding of any CIN was 72·2% when the threshold was a pathology report of low-grade SIL or less, and 40% with identification of high-grade SIL by colposcopy.

Megevand and co-workers[37] assessed the feasibility of providing cervical screening by traveling the South African countryside in a mobile clinic; they prepared for examinations by talking with community leaders. Any such educational conversation should include information on cervical cancer, methods of detection, and treatment options and, if possible, key community members should be involved in the campaign's planning and development. Seven of 25 patients had a pathology report of low-grade SIL or normal; overtreatment was 21·8% (table 1).

Two large trials[44,45] on epidemiological and laboratory features of cervical cancer by the The International Agency for Research on Cancer are in progress. One of these—a randomised intervention trial involving 160 000 women in India—aims to test screening strategies for CIN and is due to end by 2010. To choose treatment, women with positive Pap smear results are investigated with colposcopy with and without biopsy. The second intervention[45] aims to integrate cervical-cancer screening into existing health services and is under way in Mombasa, Kenya, in which outpatient treatment strategies for cervical precancerous lesions include the see-and-treat options.

In low-resource settings, morbidity from this procedure is not higher than those reported in developed countries (table 2). Given the low treatment compliance and higher incidence of cervical cancer, a much higher overtreatment rate may be acceptable for these clinical settings. Mayeaux and Harper[46] supported the see-and-treat strategy and recommended its use only in patients with CIN on Pap smear and colposcopy. Bishop and colleagues[47] reported on a survey by the Program for Appropriate Technology in Health that included

Patients	Complications	Ref
18	Postoperative bleeding, but no admission, 1 of 18 (5·5%) Brown-looking watery discharge for up to 2–3 weeks after procedure	1
149	Cervical stenosis, 12 of 149 (8·0%) Postoperative bleeding, 5 of 149 (3·3%) Inflammatory disease, 1 of 149 (0·7%)	2
981	Admission for postoperative bleeding, 6 of 981 (6·1%), 2 of which needed examination under anaesthesia and 1 of which received transfusion	7
1000	Discharge common Postoperative bleeding, 35 of 911 (3·8%). 10 of 35 needed procedures under general anaesthesia; 6 of which were treated with LLETZ cone. 3 of 35 (8·5%) received transfusion Cervical stenosis, 35 of 911 (3·8%). 22 of 911 (21.7%) occurred with LLETZ cone and 13 of 810 (1·6%) with LLETZ. Stenosis when LLETZ cone was done under colposcopy guidance, 7 of 57 (12·2%); without colposcopy guidance, 15 of 44 (34·1%)	8
118	Postoperative bleeding, 2 of 118 (1·7%)	9
47	Minor bleeding, 2 of 47 (4·2%) Postoperative cervicitis 1 of 47 (2·1%)	32
424	Secondary bleeding during first week, 32 of 424 (7·5%), 21 of which needed further coagulation Cervical stenosis, 4 of 424 (0·9%) 96 patients tried to become pregnant, 78 (81·2%) of which were successful Infertility in 18 patients, 11 of which had previously been diagnosed with infertility before LEEP treatment	33
66	Postoperative bleeding, 1 of 66 (1·5%)	36

Table 2: Clinical complications of see-and-treat strategy in clinical trials

responses from patients and clinicians in 33 developing countries. The researchers described local preferences for management of CIN and discussed treatment alternatives, including the see-and-treat strategy by use of LEEP, which was done in two visits (the first for an initial Pap smear and the second for colposcopy and treatment).

Improvement of overtreatment

As the see-and-treat strategy proved to be feasible and was accepted by physicians and patients, quality indicators were included in the *Standards and Quality in Colposcopy*.[19] The main aim was to achieve 90% correct treatment for patients undergoing the see-and-treat strategy, with the threshold for correct treatment set by a histological report of any CIN.

To assess whether these criteria were met, Smith and co-workers[48] did a retrospective chart review of a colposcopy clinic in a teaching hospital to define the optimum threshold for Pap smear and colposcopic diagnosis to meet the UK National Health Service standard for selection of the see-and-treat strategy. Results showed that when only women with severe diskaryosis, (shown by referral Pap smear and colposcopic diagnosis of CIN2 or CIN3) were treated, overtreatment based on a threshold of low-grade SIL or less was 7%. When only patients with colposcopic diagnosis of CIN3 and any diskaryosis were selected for see-and-treat, overtreatment using the same threshold was 9%.

Irvin and co-workers[38] reported on a trial that included patients with a Pap smear and colposcopic diagnosis of

high-grade SIL (table 1). Overtreatment was 18% if the threshold included patients with mild dysplasia and those with negative pathology results. Overtreatment decreased to 4% when the threshold was lowered to include only patients with negative pathology results.

Provision of training

To define the effectiveness of see-and-treat when used by health-care providers with different levels of training, Ferris and colleagues[32] organised a multicentre trial (table 1), in which supervised residents-in-training did colposcopies of patients who had abnormal Pap smears. If high-grade SIL was found, patients were offered ELECTZ or ELECTZ-cone. For low-grade SIL or less overtreatment was 55·3%, and when the threshold was lowered to include only patients with negative pathology reports, overtreatment rate remained high at 34·0%.

Two-session informed consent

Das and Elias[9] described the ethical issues in gaining informed consent from patients participating in a trial on a see-and-treat strategy. In a prospective study of 248 participants to compare the see-and-treat strategy with usual care, patients underwent a two-step informed-consent procedure. At colposcopy, all patients received detailed information about the procedure and treatment options, including the advantages or disadvantages of diagnosis and of having loop treatment during the same visit. Immediately after colposcopy, during a formal informed-consent discussion, all patients suspected to have CIN were offered LLETZ as a see-and-treat strategy. Thus, at the first step, patients were informed about their disease and the treatment options; when colposcopy was done, they were invited to participate in the research study.

A more direct approach to consent was followed by Szurkus and Harrison,[39] who studied only patients referred to the colposcopy clinic because of high-grade SIL on screening with Pap smear (table 1). All participants were counseled about the option of see-and-treat and signed an informed-consent form for colposcopy and LEEP. Colposcopy was done before LEEP, no punch biopsies were taken, and LEEP was done regardless of the colposcopy result.

Economic issues

Fung and co-workers[3] assessed the potential of the see-and-treat strategy to save costs by assessment of data on histological results of LEEP, punch biopsies, and colposcopy diagnoses from a usual-care trial; they then modelled a decision tree to compare the costs of usual care and with those of the see-and-treat strategy for a hypothetical group of 95 patients. The cost savings were US$53 000 per year if the see-and-treat strategy was used for all patients who had a colposcopy diagnosis of CIN2 or worse. As expected, costs decreased (by $73 000 per year) if the strategy was applied only to patients with a

colposcopy diagnosis of CIN3 or worse. However, costs were underestimated in this analysis because only the providers' perspective was considered: time costs for the patient and the costs of treating potential long-term effects of LEEP (eg, cervical stenosis or infertility) were not addressed.

Holschneider and colleagues[4] did an activity-based cost comparison of a see-and-treat strategy with conventional assessment and treatment of women who had a Pap smear that showed high-grade SIL by assessment of hypothetical cohorts of 1000 women for 1 year. The analysis assumed the same diagnostic effectiveness for the hypothetical cohorts, in that all high-grade SIL and all cases of cancer were identified. Costs included procedures, physician time, equipment, management of procedural complications, treatment failures, follow-up, and patient time. The researchers found that a see-and-treat strategy was cheaper than usual care, and that there were similar variations in conventional management. However, analysis assumed a 95% incidence of high-grade SIL or cancers (shown by histological assay) after high-grade Pap smear (shown by cytological assay) and thus, overtreatment for the see-and-treat strategy was very low and did not necessarily represent a population who would be seen in a diagnostic clinic.

In another cost-effectiveness analysis, Cantor and co-workers[5] compared five strategies of diagnosis and management of CIN. This study focused on fluorescence spectroscopy, although two strategies were colposcopy (in the setting of usual care) and one strategy was see-and-treat by use of colposcopy. In this decision-analysis model, comparison of expected costs with the number of cases detected by each strategy in a hypothetical cohort of 100 women found that more true positives were detected by usual care but at a higher cost. The see-and-treat strategy was cheaper by about $1000 per patient; however, it also resulted in about ten more false negatives and about eight more false positives per 100 women than did usual care. Cantor and co-workers[5] concluded that a more formal analysis, by use of outcome measures, such as cost per life year or cost per quality-adjusted life year, are needed before a policy-shaping decision could be made about the cost-effectiveness of the see-and-treat strategy.

Future research

The issues of effective treatment for CIN and of how to compare see-and-treat with usual care should be considered from several perspectives. Long-term clinical outcomes, especially survival, are the most crucial objectives; however, assessment of survival in patients with cancer in a randomised clinical trial may not be practical because of the long duration of such a study. Alternative outcome measures are needed, which could be based on cytological or histological indicators—eg, cytological results of Pap smears could be used to define

diagnostic effectiveness of usual care versus see-and-treat strategies. The changing recommendations for Pap-smear screening mean that guidelines for optimum follow-up after treatment need to be developed, specifically in terms of how many consecutive and yearly normal Pap smears are needed before a patient can undergo biennial or triennial screening. Similarly, in case of overtreatment, the frequency of follow-up comes into question and needs to be addressed in future research.

Meanwhile, as we await the results of long-term randomised clinical trials, modelling may provide useful answers:[49] simulation of outcomes based on available data may determine the appropriateness and usefulness of a see-and-treat strategy. Furthermore, modeling can incorporate issues such as clinical outcomes, quality of life, compliance, and economic cost—all of which have a role in the diagnosis and management of cervical neoplasia.

Conflict of interest
We declare no conflicts of interest.

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