Example biology essay - 2:1 level

NHS Cervical Screening Programme: Liquid Based Cytology vs. Conventional Cytology

Introduction

Cervical screening, such as the regular programme provided by the NHS, is a very successful way of detecting the early signs of cervical cancer (Kitchener, Castle, & Cox, 2006). The NHS programme screens around 3. 5 million (Moss et al., 2003) to 4 million (Karnon et al., 2004) women annually and it is estimated that this prevents between 1100 and 3900 cases of cervical cancer a year (Moss et al., 2003). In recent years a new way of screening the cervical samples has been developed. This is referred to as liquid based cytology rather than conventional cytology. However, there has been considerable debate over the costs and benefits of the new technology, as will be examined below.

Background Information

Cervical cancer is linked to human papillomaviruses (HPV), a family of common sexually transmitted viruses (Eifel, Berek, & Markman, 2011). It is believed to be fairly common for women to be exposed to HPV viral cells but usually these are readily cleared by their immune response (Bosch & Iftner, 2005). However, in some instances women can develop an HPV infection following exposure to viral cells. The infection can seem largely asymptomatic but actually causes the abnormal multiplication of cells in the cervix, leading to warts, lesions or benign tumours and, if the infection persists, it can cause cervical cancer (Bosch & Iftner, 2005; Eifel et al., 2011). In fact, HPV is believed to be the main, perhaps even the sole, cause of cervical cancer.

The NHS cervical screening programme is available to women aged between 25 and 64 years of age and involves taking a regular swab or smear of cells from inside their cervix (Moss et al., 2003). These are then sent to a pathology laboratory where they are screened by a cytologist for any abnormalities associated with HPV. In the absence of any abnormalities women between the ages of 25 and 50 years are advised to return for testing every three years, and those aged between 50 and 64, every five years (Health and Social Care Information Centre, 2013). The 2013 national statistics for the UK screening programme indicated that 78. 3% of eligible women were up to date with their smear screening (Health and Social Care Information Centre, 2013).

Cervical Cytology

The focus of this essay is on the process that takes place in the pathology laboratory, where the cervical samples are sent for cytological screening. A cervical cell sample that has no abnormal cells is categorised cytologically as being negative (negative for the presence of HPV or risk of cervical cancer). Alternatively, samples may be identified as containing borderline abnormal changes, or having dyskaryosis (Health and Social Care Information Centre, 2013). In some literature the terms dysplasia or CIN (cervical intraepithelial neoplasia) seem to be used in place of dyskaryosis (Eifel et al., 2011), but NHS literature seems to make most consistent reference to dyskaryosis. The extent of dyskaryosis is then classified across a range from mild to severe. Depending upon the severity, the woman may be referred for colposcopy or recalled for a repeat cervical smear test 6-12 months later. In the 2013 national statistics, 6. 5% of cervical samples were identified as being

abnormal, although only 1. 2% were classified as being high risk (Health and Social Care Information Centre, 2013).

Recently a new cytological screening technique has been developed, called liquid based cytology (LBC). The aim of this new method was initially to try to reduce false-negative and false-positive results (Karnon et al., 2004; Siebers et al., 2009), as well as the number of samples that are ‘ inadequate’ or ‘ unsatisfactory’ for effective screening (Arbyn et al., 2008; Siebers et al., 2009). In the conventional cytology method, a woman’s cervical sample is transferred directly from the collection spatula onto a microscopic slide (Arbyn et al., 2008; Moss et al., 2003). This transfer process seems to sometimes lead samples to be ‘ inadequate’ for screening because the transferred cells are too difficult to clearly discern. This manual process does also, very occasionally, result in false results, even when conducted by experienced cytologists. The liquid based cytology (LBC) method involves a slightly different approach to the preparation of the slides. The cell sample is placed into a vial containing a preservative fluid (Arbyn et al., 2008; Moss et al., 2003). This creates a liquid suspension of the sample, which can then be poured onto the slide in a very thin, uniform layer. However, debate remains over whether this method really offers a substantial improvement over conventional cytology. The main points of contention surround accuracy and cost effectiveness, with other arguments relating to patient anxiety and opportunities for HPV testing.

Exploring the Issues

Accuracy

Evidence is mixed over whether LBC offers a substantial improvement in accuracy compared to conventional cytology. Early studies, such as that by Monsonego et al. (2001), were very favourable towards LBC. Further, in an extension of the LBC technique described earlier, it became possible for a computerised system to read the LBC slides to identify potential areas of concern prior to examination by a cytologist (Davey et al., 2007). Across a large Australian sample of over 55, 000 women, Davey et al. (2007) found that this method of LBC was significantly better at detecting additional high grade histology cases than conventional cytology. However, more recent studies seem to undermine these reputed improvements of LBC over conventional cytology. For instance, in 2009, Siebers et al, drawing upon a sample of close to 90, 000 women in the Netherlands, concluded that LBC " is neither more sensitive nor more specific in detecting CIN or cancer" (p. 1764). This same point is reiterated almost exactly by Arbyn et al. (2008) at the end of their thorough review of the most reputable, gold standard comparison studies.

Whilst this creates a somewhat inconclusive picture, it is evident that LBC has not offered as marked an improvement in accuracy as might have been hoped. However, it is important to point out that none of the studies suggest that LBC is less accurate than conventional cytology. In fact, all of the studies mentioned above agree that LBC probably is more sensitive at picking up mild abnormalities and changes. It is just that this too is framed from a negative angle in the more recent studies because of concerns that unnecessarily following up these cases, when they are likely to be cleared by

the patient naturally, would waste resources that would be better focused on high risk patients (Arbyn et al., 2008).

There is, however, one clear point that emerges in favour of LBC in relation to accuracy. All studies seem to conclude that LBC does reduce the number of inadequate or unsatisfactory samples (Arbyn et al., 2008; Davey et al., 2007; Doyle et al., 2006; Moss et al., 2003; Siebers et al., 2009; Williams, 2006). For example, when LBC was initially trialled at three sites in the UK in 2002, Moss et al. (2003) collated data showing that LBC reduced inadequate slide preparations from 9% of samples down to 1-2%. In Scotland the difference was even greater, falling from 13% to 1. 9%, and consequently referrals to colposcopy for women with repeated unsatisfactory results dropped from 25% to just 0. 5% (Williams, 2006). These improvements substantially raise the efficiency of the whole screening programme. Therefore, it seems likely to have been these sorts of results that influenced the NHS that it would be cost effective to adopt LBC across the UK (Arbyn et al., 2008; Moss et al., 2003; Williams, 2006).

Cost Effectiveness

Turning to cost effectiveness, there are a number of aspects to take into consideration. As mentioned above, LBC may lead to a potential increase in costs if there is an increase in following up low risk abnormalities. Whilst this is framed negatively by Arbyn et al. (2008) it might be better, both for the patient and economically, to fully confirm that there is no cancer risk earlier on, rather than allowing any potential cancer to develop. Further, the significant reduction in inadequate samples may outweigh this through much larger potential savings. Reducing the number of women who are recalled

due to an inadequate sample saves valuable nursing time, reduces administration costs and reduces the costs associated with repeating the whole procedure. With these primary care benefits in mind, Moss et al. (2003) estimated that LBC could generate savings of between one to ten million pounds annually.

More recent studies have focused on the laboratory to consider whether LBC improves productivity during this part of the process. Doyle et al. (2006) studied several laboratories during the change over from conventional cytology to LBC and found that on average each scientist was able to process more samples per day. The data collated by Williams (2006) similarly demonstrated that overall workload in the laboratories decreased and backlogs were cleared. Presumably, if LBC is combined with the computerised imaging technology that automates a large part of the process, there may be further efficiency as cytologist time and effort can be focused on the samples identified to contain abnormalities.

Of course, all of this economising does not take into account the initial investment costs involved, or the on-going cost of the LBC specific materials. It is notable that both techniques mentioned in the NHS pilot study, ThinPrep and SurePath, are registered trademarks. Perhaps this is why more recent studies tend to argue that one of the disadvantages of LBC is that it is more expensive, both in terms of initial outlay and on-going operating costs (Arbyn et al., 2008; Eifel et al., 2011). Therefore, Arbyn et al. (2008) suggest that “ economic advantage might be peculiar to the United Kingdom where inadequacy rates for the conventional Pap were excessively high” (p. 175).

Patient Anxiety

Beyond economics, another important point to consider is patient anxiety. A benefit of reducing inadequate samples is the reduction in anxiety for the patient. Although the nurse may try to reassure the woman that an inadequate sample does not indicate any abnormality, it may be difficult for the patient not to fear a risk of cancer. On the otherhand, if minor abnormalities picked up via LBC are followed up, as Arbyn et al. (2008) suggest, this might create unnecessary stress and anxiety for these patients and their families. This seems to suggest that between the two technologies patient anxiety may balance out – being alleviated for some patients or created for others. However, perhaps the balance swings in favour of LBC here, as it would seem preferable to monitor cases of mild abnormality just in case these progress, rather than to create unnecessary anxiety due simply to technical inferiority.

HPV Testing

The other key advantage of LBC is the potential it offers to conduct additional laboratory tests. Preparing an LBC slide from the cervical sample uses only a small amount of the solution in the vial. Therefore, the remainder can be subjected to further tests. In particular, it is now possible for laboratories to test for the presence of HPV using HPV DNA testing (Kitchener et al., 2011). Any cases showing cell abnormalities during LBC can undergo HPV testing on the same sample. This might clarify any false-negative cases or mild abnormalities without the woman even knowing. It would also reduce the costs of referring false-negative patients for colposcopy or for an unnecessary recall screening.

Whilst controversy has largely focused on conventional cytology and LBC, the NHS actually introduced LBC in combination with HPV testing (Moss et al., 2003). Recent studies have demonstrated that HPV testing may be more powerful than cytology, and suggest it may come to replace cytology as the primary screening technique (Katki et al., 2011; Kitchener et al., 2011). Katki et al. 2011 advocate that one negative result via HPV testing offers " strong reassurance against cervical cancer for five years in women from age 30" (p. 1470). This could significantly reduce primary care costs as currently women aged 30-50 are tested every 3 years under the NHS screening programme. Kitchener et al. (2011) have gone further than this, suggesting that HPV testing might even allow the interval between cervical screens to be extended to every six years.

Conclusion

There has been significant debate around the shift from conventional to liquid based cytology when screening for cervical cancer. This has been particularly heightened given the evidence that LBC does not appear to reduce false-positive or false-negative results in the way that had been hoped. However, in the UK at least, LBC significantly reduces the number of ' inadequate' samples, reducing primary care costs and patient anxiety in these cases. Although it is a little unclear whether LBC is more cost effective when all costs are taken into consideration, it seems that by investing in the technique the NHS is now well placed to quickly and easily adopt new scientific developments, such as wide-scale HPV testing. Given LBC, HPV DNA testing and the HPV vaccination, cervical cancer prevention seems to be a rapidly advancing area of science where new developments progress fairly

quickly from research into routine health practice. Therefore, it seems wise that the NHS chose to invest in LBC and HPV testing when it did so that it can keep apace, and continue to offer cutting edge cancer screening to women.

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