



Harmful Effects

Smoke from diathermy and lasers has been shown to contain low concentrations of toxic gases and vapours such as benzene, hydrogen cyanide, formaldehyde, bioaerosols, dead and live cellular material (including blood fragments and viruses); these produce an unquantified infection risk. The smoke causes ocular and upper respiratory tract irritation, is highly obnoxious, and creates visual problems for the surgeon. There is evidence of mutagenic potential. Currently there is no evidence of human carcinogenicity, but there are persistent concerns.

Exposure

Electro-surgical techniques and laser surgery have expanded greatly in recent years. Depending on the nature of the surgical site and the length of the procedure, staff (especially the surgeons and scrub nurses) can be exposed to smoke for periods ranging from a minute or so, repeated infrequently, to several hours a day. The intensity of exposure also varies. This is most manifest in how obnoxious the smell is; the possible presence of particular contaminants will also vary with the surgical site and the patient. Few reliable measurements have been made. Present indications are that particulate exposures are to less than 0.01 mg/m³.

Precautions

Theatres usually have high rates of general ventilation. This does not, however, prevent the emission of smoke into the room or the exposure of staff. Local exhaust ventilation (LEV) is required to achieve this. The known irritancy, the other hazardous properties of the component contaminants, and the persistent concerns of chronic effects combine to lead to the conclusion that effective LEV should be considered a required control measure. Short procedures such as spot coagulation repeated infrequently are, however, thought unlikely to produce a significant risk to health even without LEV.

LEV for surgical smoke control is still being developed. Two current approaches are purpose designed portable smoke evacuators and room suction systems. Smoke evacuator systems can be add-on units or supplied as part of the diathermy or laser equipment package. For fine work and where space is limited, extraction systems designed as part of the device are usually less cumbersome. None are without some impediment to the ease of use by the surgeon.

Smoke evacuators comprise a suction unit, filter, hose, and extraction nozzle. Smoke particles are extremely fine; a HEPA filter is therefore required and must be combined with organic vapour filtration if the extract is fed back to the room. A velocity of 0.5 - 0.75 metres/second at the inlet nozzle is generally recommended but recent research by HSE's Health and Safety Laboratory (on soldering devices) indicates that extraction volume is more significant. 22 litres/minute (1.3m³/hr) is the minimum considered effective. Well designed LEV systems have been found to be moderately effective; trials in actual use are essential. There are no exposure limits so subjective criteria must be used: reducing smells, clarity of vision, ease of use.

Piped suction systems extract at lower rates and are designed for different clinical purposes. If these systems are used to capture smoke: appropriate filters should be used, the line should be cleared periodically, and filters must be disposed of as clinical waste. Suction systems are usually less effective in removing smoke and should be seen as a stop-gap solution unless in particular circumstances smoke removal is found to be adequate. In all cases, the extraction nozzle is effective only if it is very close to the surgical site (less than 50mm). Trials are essential.

Having established the system, users must be trained in effective application, and local rules established to govern its consistent use. If practicality requires exceptions, this should be approved by senior staff and a competent adviser. Tubing, filters and absorbers must be disposed of as clinical waste. The arrangements for replacement should be established with the approval of infection control staff.

Occupational Health

The irritancy of surgical smoke may affect some staff (especially asthmatics) adversely despite effective LEV. Anyone reporting respiratory symptoms should be referred to the occupational health service.

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