37 Terminal care & oncology

37.1 A task for every district hospital

One of the first historical tasks of medicine was to comfort the dying and relieve their suffering. Much of this is due unfortunately to preventable disease complicated by delays, lack of treatment or inappropriate treatment (and this includes HIV disease) as well as to malignant disease, which causes severe pain in about 70% of cases. Every day probably >5 million people endure such pain, and only a fraction of these have any alleviation. This usually needs only simple drugs, which are so often successful that they should be available to everyone.

The development of hospices, and their outreach into the community, is helping and respecting the dying, as well as alleviating their pain and their other distressing symptoms. Where hospices have yet to be established, district hospitals have to fill this role. Unfortunately, many of them provide no terminal care whatever: its provision is one of the indicators of 'good care'.
Any patient who receives terminal care is, by definition, going to die. It is therefore only too easy to neglect him. Your own attitude to him and that of your staff is critical. He must feel welcomed by people who are determined to help him. There is always something to be done to make his last days more bearable, even if he is dying. *Never send him back home immediately*; he has come to you for help. A long family discussion may have taken place before he came, and if you send him back home without extensive discussion and explanation, after his family have wasted much effort and expense, he will feel rejected, and so will his family, who may be induced also to reject him as a 'hopeless case'. Actively exclude any differential diagnosis that may be curable. *Do not make the mistake of assuming HIV disease unless it has been proved* (5.5), *nor forget thyrotoxicosis as a cause of weight loss*.
It is important not to leave the patient out of the discussion otherwise you will create a barrier between him and his family which neither may be brave enough to cross. Remember the stages of grief (according to the Kübler-Ross model): denial, anger, opposition and finally acceptance.

You will have to decide whether to continue to treat him in hospital, or at home. Make this decision on:
(1) The extent of the suffering he will undergo at home from bed sores, from malignant ulcers, and from difficulty with his toilet arrangements, etc. For example, if he needs a catheter which must be changed every month, is there a health unit near him which can do this?
(2) His own wishes, and those of his family.
(3) The length of time he has to live.
(4) Financial considerations.
(5) His desire to die at home (which may be very important in certain communities): it is often much more expensive to transport a dead body than someone who is still living!
(6) People may view your hospital with scepticism, if you admit too many patients just to die, as their relatives may really believe you can do something to reverse their condition.

Try to palliate the symptoms of death. You can:
(1) Always alleviate intolerable pain with drugs.
(2) Arrange radiotherapy, chemotherapy (37.4), or surgery, after you have weighed up the benefit to be gained against:
  (a) further suffering,
  (b) affordability of treatment,
  (c) availability of transport etc..

Unfortunately, 'altering the symptoms of death' can sometimes make them worse. An intolerable and burdensome indignity in one culture (a colostomy for example), may be quite acceptable in another. So make sure that whatever you do, for cure or palliation, does not make his symptoms worse, and, particularly, *does not prolong a final illness painfully*. For example, a gastrostomy (13.9) may keep a patient with carcinoma of the oesophagus alive for months but he remains unable even to swallow his own saliva, which he aspirates into the bronchial tree.

Usually, there is no further need for antihypertensive, diuretic or oral hypoglycaemic drugs in the final stages of terminal illness. Assess carefully whether you should prescribe these medications.

Tell the patient, *and* his family, about his illness. This should not be difficult, but you will have to appreciate the local culture. Usually, you will have to tell the full story to the patient *and* a responsible relative. Many patients do not really understand what malignancy is and to many, illness is a spiritual matter.

If you tell him nothing, pretending that he is going to get better, he may eventually lose all faith in you, and alas even in his family, who have conspired to deceive him. In contrast, many patients have thanked their doctors for telling them the truth. It gives them time to prepare for their own end. This is important in many faiths, where a priest may need to be specially called in.

Unfortunately, some patients cannot accept the whole truth immediately. So judge this carefully. How much of the truth is he really able to take at a time? Whatever you tell him, it must be true. You do not have to tell everything at once, but you must not minimize the problems by obscuring the realities.

You should always start with the truth because:
(1) The patient is going to get worse anyway, and will eventually know.
(2) The relatives will know about any falsehoods, and when their turn comes to be ill, they will not know whether to trust their doctors and especially you.
(3) The patient may have personal matters to set in order.
(4) You will save him the expense of going from doctor to doctor, vainly seeking a cure.
(5) You will relieve his family of the responsibility of knowing what to say to him.

Do not be drawn into telling a patient 'how long he has got to live' because you may be hopelessly wrong, and many patients and their relatives may take your answer literally if you give a figure or a date!

If one of the differential diagnoses is a curable condition, be sure to investigate sufficiently to exclude it. Unless you do this, you will miss diseases that could have been treated. So *do not accept a diagnosis of malignant disease until it is confirmed*, preferably by biopsy. *You should never tell a patient he has a malignancy without proof*. If you later try to tell them the diagnosis was wrong, they will be confused and lose confidence in you.

Many patients have indeed been palliated for supposedly malignant disease, only to be shown at post mortem to have had some treatable condition. What you may think is a hepatoma (15.11), may turn out to be a liver abscess (15.10); a rectal lesion may be an amoeboma (14.5), and not a carcinoma (12.11); 'malignant ascites' may in fact be tuberculous (16.2). Also be sure to have proof of HIV disease: *do not assume it*!

MARY (24yrs) who had led a rather tumultuous as a teenager, and had run away from home, had lost a huge amount of weight, had diarrhoea, had a persistent tachycardia, and low grade fever and had developed sores on her body. Because of her past, everyone assumed she had HIV disease, especially when one of her former partners died of HIV complications. However, a conscientious doctor took a good history, examined her and did one relevant blood test: she was thyrotoxic!
LESSON: *Do not assume HIV disease until it is proven.*

Remember palliative surgery may be very effective in pain relief especially in situations of obstruction: colostomy for obstructing colorectal cancer (11.6), gastrojejunostomy for stomach cancer (13.10), cholecystojejunostomy for cancer of the head of the pancreas (15.9), tracheostomy for laryngeal cancer (29.15), amputation for a very painful limb (35.3), orchidectomy (27.26) for prostatic cancer or perhaps excision of a fungating breast tumour (24.5).

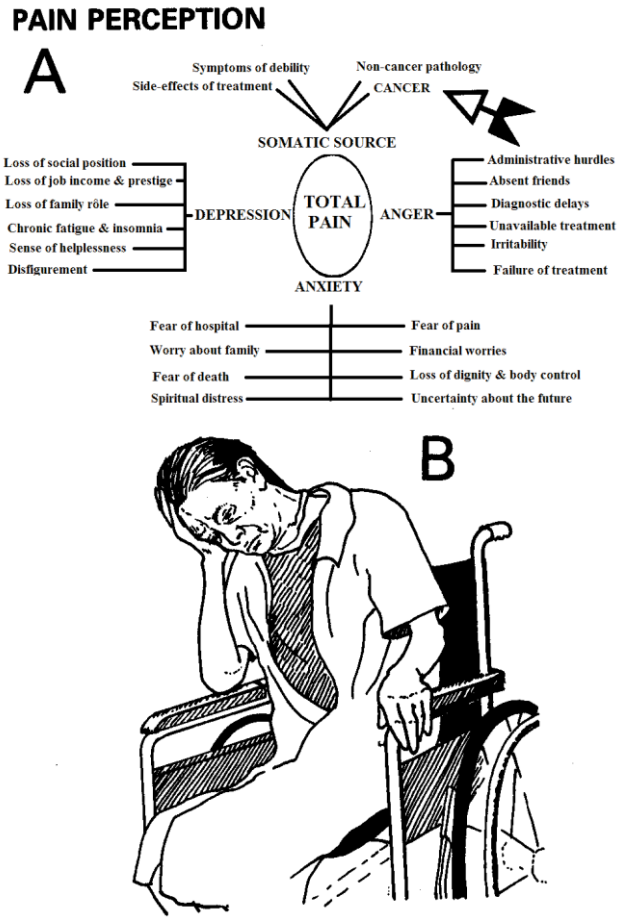

Fig. 37-1 PAIN PERCEPTION.
A, shows the factors that influence a terminal cancer patient's total perception of pain. Only one of these is the cancer itself. Try to influence as many of the other factors as you can. B, the patient herself. *After Cancer pain relief and palliative care. WHO Technical Report Series 804, 1990 Fig 5, p.21. (WHO 90746)*

37.2 Controlling cancer pain

When a patient has cancer, its physical effect is only one determinant of his 'total perceived pain'. The perception of pain is profoundly modified by his psychological state, and by spiritual, social, and financial factors. Depression, anxiety, anger, hopelessness, and a fear of impending death can all add to suffering, and worsen the pain. Taking the edge off anxiety with chlorpromazine, for example, may greatly reduce the total perceived pain, and may help with other factors, where this is possible. Although chlorpromazine is a tranquillizer, and is not an analgesic, it may be so effective in altering an anxious patient's 'total perceived pain', that no analgesic is required. In the control of cancer pain chlorpromazine and drugs like it are called 'adjuvants'. If an adjuvant alone fails, start the patient on WHO's three-step ladder (37-2).

This consists of:
(1) A non-opioid (aspirin or paracetamol). If these fail, you can try other non-steroidal anti-inflammatory drugs (NSAIDs) than aspirin but they tend to be more expensive and *all* are gastric irritants, so add antacids or anti-H_2 blockers.
(2) A mild opioid (codeine, or tramadol).
(3) A strong opioid (morphine). All of them can be used with or without an adjuvant. Strictly speaking, the use of an 'adjuvant alone' is not one of the steps on the WHO ladder, which starts with Step 1 (a non-opioid, perhaps with an adjuvant). Chlorpromazine alone ('step zero') may be a valuable initial step, and may be easier to continue at home, especially in a community with a poor understanding of the potentially harmful effects of strong analgesics. The effects of opioids and non-opioids are additive, and make a useful combination, in that non-opioids act peripherally, whereas opioids act centrally.

Make sure that patients know that pain can be treated. Use drugs *regularly* every 4hrs by the clock or continuously IV. Make sure you use them before the pain starts again, and *do not prescribe them 'as required'*. Use the oral route, where the gastro-intestinal tract is working well, and allow the patient himself or his family to administer the drugs appropriately. When the patient needs morphine, *do not be afraid to supply it:* almost all pain yields to it. So *do not underprescribe or underdose*. It might be easier to use opioids as an out-patient because of strict controlled drug control policies within the hospital. If legislation controlling the availability of opioids makes this difficult, strive to have it changed. The right dose, of the right drug, at the right time, will completely control cancer pain in 90% of cases. Drugs are much less successful in many forms of non-malignant pain.

Be careful to distinguish:
(1) Tolerance, which is a state in which increasing doses are needed to maintain the initial analgesic effect.
(2) Physical dependence, which is the onset of acute symptoms and signs, when the drug is discontinued.
(3) Psychological dependence, which is the craving that is shown by drug abusers.
Tolerance to opioids is common in cancer patients, but is rarely a problem, and physical dependence does occur. Psychological dependence is rare, and is unimportant, because the patient is going to die anyway. *Do not withhold opioids from dying patients "because they might get addicted"*!

Finally, *do not remove the dignity of dying*. We have all got to die one day. Respect the wishes the dying person has. Many may wish to die surrounded by their family, and not by oxygen, tubes, cardiac monitors and alarm buzzers, and with tubes in our every orifice.

PAIN CAN BE RELIEVED:
PRESCRIBE DRUGS 'BY THE CLOCK'

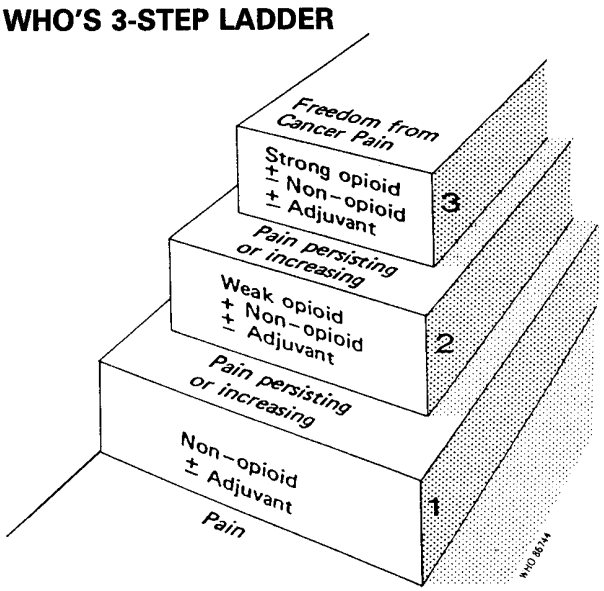

Fig. 37-2 THE WHO 3-STEP LADDER OF PAIN RELIEF will deal with the pain of about 90% of cases of terminal cancer. Prescribe a patient the right dose of the right drug at the right time. Prescribe it at regular intervals, and *not merely on demand.*
After Cancer pain relief and palliative care. WHO Technical Report Series 804 #891021, 1990 Fig 1, p.9

PAIN ASSESSMENT.
Ask about the location, distribution, quality, and severity of the pain; whether it is continuous or intermittent, and what factors make it worse or better. Pain precipitated by movement is likely to be less easily relieved than persistent pain. Enquire the extent to which it limits sleep and other activities, and ask the patient to compare it with other pains (toothache, labour pain etc). Assess it on a scale of 0-10, with 10 being the worst pain the patient can imagine. Let him give you a value of his own pain score every time you see him. Evaluate his psychological state (anxiety, depression, suicidal thoughts, etc.), so that you can assess his 'total perceived pain' in terms of its physical, psychological, spiritual, social, and stress components. Consider special types of pain, and the relief of other symptoms.

THE ANALGESIC LADDER. Use drugs in the following order, with the aim of progressively:
(1) Increasing hours of pain-free sleep.
(2) Relieving pain when at rest.
(3) Relieving pain during standing or activity.

Titrate the dose of the drug you give against the amount of pain, gradually increasing it, until you get the effect you want. Prescribe each dose by the clock, before the effect of the previous one has fallen off, so as to remove the memory and fear of pain.

Use the WHO pain ladder (37-2):
(0) Use enough chlorpromazine to cause drowsiness, especially at night and use it regularly.
(1) If chlorpromazine is not enough, add a non-opioid (aspirin or paracetamol). Replace aspirin with another NSAID if the patient finds it more effective (and he can tolerate it).
(2) If chlorpromazine and non-opioids are not enough, add a weak opioid (codeine or tramadol).
(3) If chlorpromazine, non-opioids, and a weak opioid are not enough, replace the weak opioid by a strong one (morphine). The indication for morphine is the intensity of pain, not the brevity of the prognosis. Pethidine, fentanyl and tilidine have shorter durations of action and are not very suitable for terminal care.

Alternatively, omit any of these stages if necessary. **If a drug ceases to be effective**, *do not change to an alternative of similar strength*. Instead, go to the next step, and prescribe one that is definitely stronger.
When a patient goes home, he ideally needs the same drugs as in hospital. Prescribe plenty of chlorpromazine, and if necessary aspirin or paracetamol. If he needs opioids, explain their dangers and that they are to be given to nobody else. If you think the relatives are unreliable, try to arrange hospice care.

MONITOR THE PAIN. Do this within 4hrs, within a few days, and always after 1wk. Make sure that treatment continues to match the pain with the minimum of side and toxic effects. Try to anticipate & prevent them, and treat them systematically, especially constipation and nausea.

CAUTION!
(1) Determine the analgesic dose for patients individually.
(2) Always use oral drugs where you can.
(3) Pain is often worse at night, so treat insomnia vigorously. You may be able to double the opioid dose at bedtime in order not to wake the patient to administer a night-time dose.
(4) Exclude acute conditions that require urgent treatment.
(5) Learn to use a few drugs well, and *do not search desperately for one which will suit better*.
(6) If you decide to allow him home with a strong opioid, his relatives must understand its dangers, and return any drugs which are not used. You may need to collect these.

ADJUVANTS
Chlorpromazine is a *Group 1* phenothiazine which has pronounced sedative effects, but moderate anti-muscarinic (dry mouth, hypotension, blurred vision, urinary retention) and extra-pyramidal (tremor, facial tics, restlessness) effects. Start with 75mg nocte.
If anxiety persists during the day, add 25mg tid up to a total daily dose of 300 mg. (In severe psychoses, increase this to 1g daily.)

Thioridazine is a *Group 2* phenothiazine with moderate sedative, marked anti-muscarinic, but mild extra-pyramidal effects. It is useful in the elderly disturbed patient. Start with 50mg od up to 300mg od.
NB. Rarely, this drug can cause ventricular dysrhythmias.

Fluphenazine, perphenazine, prochloperazine, trifluoroperazine are *Group 3* phenothiazines with less sedative, less anti-muscarinic, but more extra-pyramidal effects. They are useful for their anti-emetic effects (especially prochlorperazine).

Haloperidol is a butyrophenone with properties like the *Group 3* phenothiazines is useful for the severely agitated from 0·5mg od to 3mg tid according to response. Unlike the other drugs, it can be given to children at 12·5-25μg/kg bd.
CAUTION *Do not use more than one antipsychotic drug at the same time.*

NON-OPIOID ANALGESICS

Paracetamol 0·5-1g every 4-6hrs is universally available and cheap. As a result it is maligned by both doctors and the public, but remains an extremely effective analgesic. Overdosage is dangerous because liver damage results, which may not be apparent for a week, especially in alcoholics and those taking anticonvulsants.

Aspirin 300-900mg every 4-6hrs is also universally available and cheap. It has anti-inflammatory properties and so can be used in combination with paracetamol. Its limitation is its gastric irritation effect. Other NSAIDs may be better tolerated (mefenamic acid, naproxen, piroxicam indomethacin, ibuprofen, diclofenac) but they all cause gastric irritation. Piroxicam is useful as it has a prolonged duration of action.
N.B. All non-opioids act outside the brain.

WEAK OPIOID ANALGESICS

Codeine phosphate 30-60mg every 4-6hrs is very useful and not used enough. It is seriously constipating, and so, unless there is diarrhoea, combine it with a laxative every other day.

Tramadol 50-100mg qid is a newer opioid and is very useful, but remains expensive. It can give hallucinations.
N.B. Tolerance and dependence are unusual.

Buprenorphine 200-400μg qid sublingually or by skin patches is very useful because of its prolonged (8hr) action, but is more expensive. Dependence can be a problem, and respiratory depression is only partially reversed by naloxone.

STRONG OPIOID ANALGESICS

Morphine 5-10mg 4hrly orally, as a starting dose, and increasing when necessary, to 200mg or more 4hrly. Most patients are best controlled on 5-30mg every 4hrs by the clock. This is most easily given as solutions of morphine sulphate 1-20mg/ml in 5% alcohol, or chloroform water, as a preservative, stored in a dark bottle and not exposed to sunlight. Morphine is bitter, and you may prefer to mask the taste by taking it with some other drink. Try to get this mixture made up locally. If necessary, you can mix in 50-100mg of chlorpromazine in each dose. Capsules of morphine exist but are expensive. Most palliative care patients need 75mg/day for the last 3months of their life for adequate pain relief.

Constipation may be more difficult to control than pain. Almost all patients receiving regular morphine need a laxative every other day.

Most patients receiving regular morphine need an antiemetic such as chlorpromazine (which the patient may be using already), or prochlorperazine 5-10mg tid increasing to 4hrly, or metoclopramide 10mg tid increasing to 4hrly, or haloperidol 1-2mg od.

Efficacy decreases with repeated use (tolerance), so that increasing doses are needed (37-3). Withdrawal symptoms may occur if treatment is stopped abruptly (physical dependence).

Occasionally opioids cause neurotoxic symptoms: delirium, hallucinations, myoclonic attacks and also hyperalgesia or allodynia (excessive sensitivity to pain). In this case, ensure good hydration and stop the current opioid and use an alternative, calculated for equal effect, reduced by 25% to account for cross-over tolerance:

Morphine 10mg = Codeine 100mg =
Tramadol 40mg = Buprenorphine 150µg

Opioids cause respiratory depression: treat an acute overdose with naloxone 0·4-2mg IV every 2-3mins until respiratory function improves. Consider if this is really appropriate with a terminally ill patient.

MUSCLE RELAXANTS

Diazepam 5-10mg od is as effective as any other relaxant in treating muscle spasms. It helps also as a night sedative, although other benzodiazepines may give less hang-over effect. It is important, though, to remember that the quality of sleep is poorer with sedatives because the regeneration of the body is less.

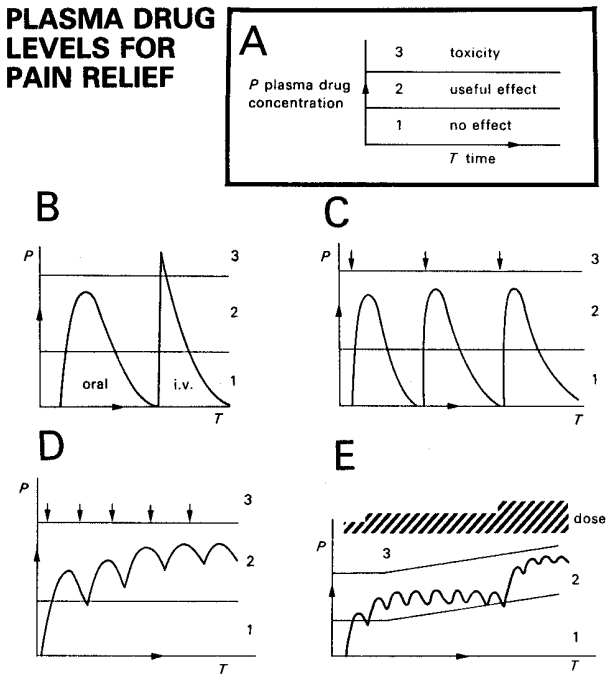

Fig. 37-3 PLASMA DRUG LEVELS FOR PAIN RELIEF.
A, plasma concentration zones in relation to drug effects. These same zones are used in the diagrams which follow. B, plasma concentration-time curves for an oral, and an intravenous dose. Notice that after an oral dose the concentration rises to a lower peak, and persists longer. C, doses are too widely spaced to maintain analgesia. Larger doses at the same time intervals would risk toxicity. D, doses spaced satisfactorily to maintain analgesia (4hrly for morphine). E, effects of tolerance. The thresholds between no effect and a useful effect and between a useful effect and toxicity are rising.
After Vere DW, Oxford Textbook of Medicine, OUP 1983.

GASTRO-INTESTINAL ANALGESICS

Loperamide 2-4mg qid and/or **hyoscine hydrobromide** 300µg qid may help colicky intestinal pain.
Antacids and **metoclopramide** will help with gastric distension, and hiccough.

Cyclizine 50mg tid, or **domperidone** 10-20mg tid are useful adjuncts for nausea.
Remember to use laxatives if there is constipation, which is common and very distressing for the patient. It is an almost invariable side-effect of opioids.

NEUROPATHIC ANALGESICS

Amitryptyline 10-25mg**, carbamazepine** 100-200mg bd, or **phenytoin** 150-300mg nocte are useful for shooting or stabbing pains. They will also control convulsions caused by renal failure or cerebral oedema.

If there is a specific point giving rise to pain or a specific nerve involved, inject the site with **methylprednisolone** 40mg (or **hydrocortisone** 200mg) in 2ml **lidocaine.**

STEROIDS

Dexamethasone 4-8mg od (or **prednisolone** 30-60mg od) is especially useful to decrease chronically raised intracranial pressure, pain from nerve compression as well as chronic bronchospasm. It may improve appetite and promote a sense of well-being.

DIFFICULTIES WITH TERMINAL CARE

If you cannot rely on regular doses of opioids, you may be able to use a continuous IV infusion: 100mg morphine in 1l 5% dextrose at 25-50 drops/min provides 0.1-0.2mg/kg/hr for a 70kg patient.

In a child, adjust doses appropriately. Anxiety and nausea are usually more of a problem.

If there is bone pain from metastases, arrange radiotherapy if possible.

If there are bed sores, turn the patient 2hrly, clean the wounds and debride them if necessary (34.16).

If there is a smelly ulcer or fungating tumour, use metronidazole 400mg tid and apply yoghurt or honey 4-6hrly.

If there is intractable vomiting, put up an IV line and pass a nasogastric tube (4.9) and use an antiemetic IV, or PR. This will relieve nausea: intractable vomiting is a horrible way to die. Try metoclopramide, chlorpromazine, prochlorperazine, domperidone, or cyclizine. *Avoid metoclopramide and domperidone if vomiting is due to malignant bowel obstruction*, because they increase bowel motility, and may make things worse. Use dexamethasone if you suspect cerebral metastases.

If there are excessive respiratory secretions, try hyoscine 0·4mg qid sc.

If the mouth is dry, check the hydration, make sure there is good mouth care, and suggest sucking of ice or pine-apple. Treat any candidiasis present. Stop hyoscine and reduce opioids.

If there is dyspnoea from a pleural effusion, drain it (9.1). When the effusion is fully drained, insert some talc to cause an inflammatory reaction to cause the pleural surfaces to stick together (36.1).

YOUR ACTIVE INTEREST IS ESSENTIAL!

37.3 Treating malignancy in a district hospital

Malignant disease is a worldwide problem but many cancers are avoidable (*viz.* Kaposi sarcoma & HIV, hepatoma and hepatitis B, bladder carcinoma and schistosomiasis, bronchial carcinoma and smoking). Incidence rates vary markedly in different parts of the world; in the developing world the five most prevalent are: cancer of the cervix, stomach, mouth, oesophagus, breast, with cancer of the liver and lung, lymphomas and leukaemias not far behind.

In some areas, certain cancers are very common (*viz.* Kaposi sarcoma in Subsaharan Africa, bladder carcinoma along the Nile, Burkitt's lymphoma in Central Africa, nasopharyngeal carcinoma in southern China)

Although many malignant tumours can now be cured, if they are diagnosed sufficiently early, and treated appropriately, most of the patients who consult you will probably have such advanced disease that the help you can provide will be limited. Although a few tumours can be managed optimally with very limited facilities, many cannot. Nevertheless, if such a cancer is treatable, particularly for children, try to find the effective treatment.

Although malignant disease kills huge numbers of people worldwide, its treatment and cure is usually very expensive; however the relief of suffering is often *not* very costly. Moreover, there is always something you can do, even if only good terminal care (37.1).

Your hospital may be a long way from any referral centre, so that if you do not diagnose and treat a patient with cancer, it is likely that nobody else will. You may be unable to get prompt and reliable histological reports, or even any reports at all, and there will almost certainly be no one to examine frozen sections for you. You are unlikely to be able to refer anyone for radiotherapy, or even perhaps for expert surgery, so you will have to rely on simple surgery, and some of the easier and cheaper chemotherapeutic regimes. Keep costs in mind, especially if these have to be borne by the relatives, and the possible benefit of expensive treatment. Remember the possibility of complications and side-effects. *Do not end up by making things worse*!

MANAGEMENT OF MALIGNANT DISEASE

Make the diagnosis of malignant disease clinically, and examine the patient carefully to assess its extent. Assess the complications.

Confirm the diagnosis histologically before you start treatment unless you have strong evidence of Burkitt's lymphoma (17.6), *e.g.* on cytology. If you are excising a lymph node (17.3), take the whole node if this is easy, but if it is not, a part of the node will do. If you are sending away a node for histology, always cut it across: with experience you will be able to recognize the caseation of tuberculosis, and to distinguish hyperplasia from a tumour. *Don't wait for the result if you think TB is a real possibility: start treatment.* However, after taking a biopsy for malignancy, wait for the histological report before starting toxic chemotherapy.

N.B. When you take tissue from an ulcer or a large mass, take some from the edge of the lesion, so that you include normal and abnormal tissue.

Stage the tumour according to standard criteria. Most malignant tumours have 4 stages, or sometimes 5, some of which may be subdivided. The first 2 stages are usually curable, whereas the last 2 can usually only be palliated. Be thorough, and assess the tumour carefully: you may need a GA. Both the stage of a tumour, and often its histological grade, influence the prognosis, both with and without treatment. Occasionally, you will see some large resectable tumours, malignant or benign (24-7). *Do not assume that a tumour is malignant, until you have proved it so*.

Decide what is best for the patient. Can you treat him? Can someone else treat him? Can nobody treat him? Should you aim for cure or palliation? For example, chemotherapy can usually achieve a radical cure with Burkitt's lymphoma (17.6), and quite simple surgery can cure skin (34.5), early breast (24.4) and penile cancers (27.33). Palliation may greatly help a patient with prostatic cancer (27.22), pancreatic cancer (cholecystojejunostomy), or oesophageal cancer (insertion of a prosthetic tube). A chest drain may relieve a massive pleural effusion, whose recurrence you may forestall by installation of talc (9.1). Often though, you can do little, because both surgery and chemotherapy may only prolong his suffering and that of his relatives.

Decide if you are going to try to refer the patient, or treat or palliate yourself. If a referral centre can do nothing for him, *do not refer him*. If private doctors cannot help him, *persuade him not to waste his money on them*.

When you make the difficult decision as to whom to treat and whom only to palliate, base your decision on the response of the tumour, and not on the patient's political influence, his social status, or on his ability to pay for the drugs. It is hard to be realistic when it comes to recommending palliative chemotherapy! Unfortunately, in places where medicine has to be bought by individual patients, the poor are likely to get nothing. Even so, make every effort to have some drugs available to treat such conditions as Burkitt's lymphoma (17.6) and choriocarcinoma (23.10).

You will also have to decide where the treatment of tumours comes in your own priorities, when more cost-effective calls on your resources are so great.

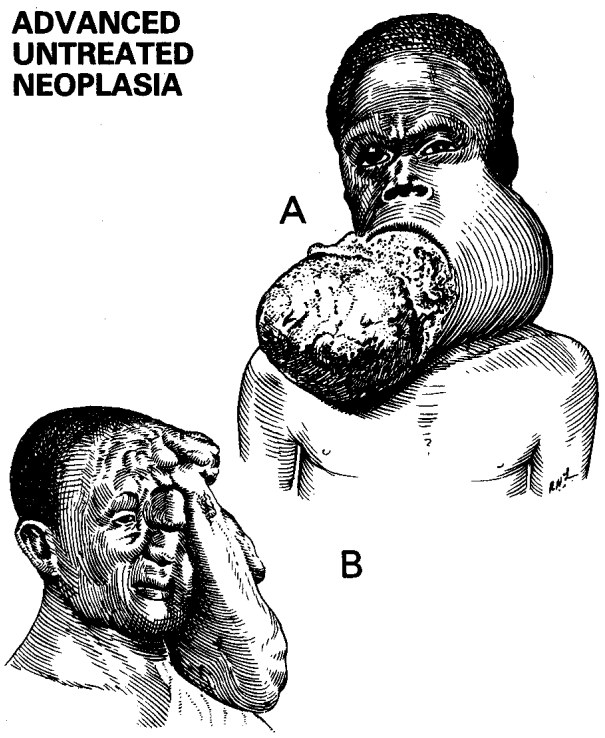

Fig. 37-4 ADVANCED UNTREATED FACIAL NEOPLASIA.
A, very large giant cell tumour of the mandible (31.6) **in a boy of 12yrs. B, large angiosarcoma (**34.15**) of the blood vessels of the scalp. In the absence of adequate treatment tumours may become massive.**
After Bowesman, C, Surgery and Clinical Pathology in the Tropics. Livingstone, 1960 with kind permission

SENDING SPECIMENS. When you fix a tissue, place it in at least twice its volume of formol saline, which is 100ml concentrated (40%) formaldehyde solution with 9g salt in 900ml water. Send small specimens in a screw-capped universal container inside a plastic bag in a cardboard box, jiffy bag or padded envelope. Alternatively you can use the tied-off finger end of used gloves for very small specimens.

Or, fix the specimen first in formol saline for a few days, then wrap it in formol-saline-soaked cotton wool, pack this in a plastic bag. *Make sure it does not dry out in transit.*

N.B. If you want to send a very large specimen for histology, such as an entire kidney, cut it so that the fixative can reach its interior, but leave the slices together at one edge, so that they can be put together again, and the shape of the specimen is preserved. Fix the whole specimen in a bucket of formol saline. When it is fixed, seal it in a polythene bag, pack it in a cardboard box; you may then have to send it by messenger!

CAUTION! The danger in sending pathological specimens is that they will leak in the post, contaminate the mail, and make you very unpopular with the post office!

N.B. Remember to label & orient your specimen carefully, with a hospital number in case the name is unreadable, and give accurate clinical information to the pathologist on your request form.

37.4 Primary cancer chemotherapy

For chemotherapy you will need an accurate scale to measure weight, and a height scale on the wall. From these you can work out a patient's surface area. You must also be able to measure the blood urea, the haemoglobin, the total and differential white count (from which you will be able to work out the absolute granulocyte count), and if possible the platelets.

Before you use any cytotoxic agent, you must decide if the misery, which its side-effects may certainly cause, will outweigh the benefit you expect it to have. Chemotherapy is one of the treatment methods for which compliance is absolutely necessary. The indications for chemotherapy are limited but:
(1) if you *do not treat cancer patients*, it is probable that nobody else will either;
(2) some drugs are comparatively cheap, and some regimes are practical and highly effective, particularly those for Burkitt's lymphoma (17.6), for which treatment is urgent;
(3) patients and their families much prefer to be treated near their own homes;
(4) it is often cheaper for patients to obtain their cytotoxics elsewhere (if you cannot supply them) and bring them to the hospital for you to administer.

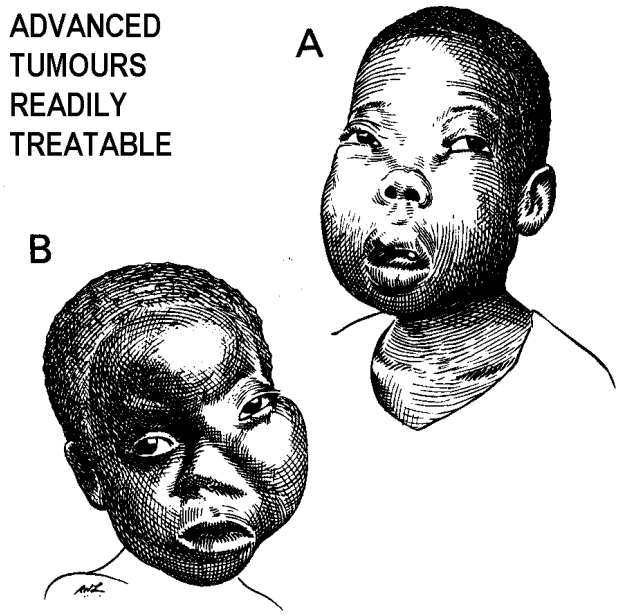

Fig. 37-5 BURKITT'S LYMPHOMA (17.6) **should be your 1st priority for chemotherapy. A, note the swelling of both maxillae. B, note the protrusion of the eye: *without immediate treatment, vision will be lost.*** *After Bowesman,C. Surgery and Clinical Pathology in the Tropics, Livingstone, with kind permissio***n**

Unfortunately, there are no other tumours which are quite so readily treated by chemotherapy as Burkitt's lymphoma. You need to know where chemotherapy alone or adjuvant chemotherapy (*i.e.* in association with surgery) is useful.

NARUNDRNATHAN (2½ yrs) complained of a loose tooth and swelling of the upper jaw, which had started 2wks previously. He was taken to a dentist, who noticed proptosis in the left eye, and referred him to the children's ward. Here he was found to have several abdominal masses, was diagnosed as having Burkitt's lymphoma, and was referred to the teaching hospital. There was no money left in the transport vote to buy petrol for the hospital ambulance, so his parents took him there by bus. The consultant oncologist was away at a conference in Oxford, so he was sent back again, and asked to re-attend 1wk later. While he was waiting to be sent to the oncologist again, he died, after a total history of less than a month. LESSONS (1) The diagnosis of Burkitt's lymphoma is usually sufficiently distinctive for treatment to be started without waiting for a biopsy report. (2) Burkitt's lymphoma needs urgent treatment, which should begin within 48hrs, is not expensive, and is highly effective.
(3) Treatment is easily possible in a district hospital.

Use the WHO tumour categories:
Category 1: Chemotherapy will cure or significantly prolong life:

Acute leukaemia, lymphoma, gestational trophoblastic disease (GTD), seminoma, teratoma, nephroblastoma, neuroblastoma, rhabdomyosarcoma, Ewing's sarcoma, small cell lung carcinoma, retinoblastoma, and Kaposi sarcoma.

Category 1/2: Chemotherapy usually prolongs survival:

Breast carcinoma, osteosarcoma.

Category 2: Chemotherapy will reduce tumour size, improve the quality of life and may prolong life:

Chronic leukaemia, multiple myeloma, ovarian carcinoma, endometrial carcinoma.

Category 2/3: Chemotherapy may reduce tumour size, but overall benefit is equivocal:

Most remaining malignancies.

Category 3: Chemotherapy is of absolutely no benefit:

Melanoma, hepatoma.

Chemotherapy in a district hospital is never easy. Your laboratory facilities may be minimal, your drugs limited, your nurses inexperienced with chronic cancer patients, and your rehabilitation facilities rudimentary. You do however have two advantages; you can follow up a patient more easily than a referral centre, and his relatives are likely to live much nearer.

Use the KARNOFSKY PERFORMANCE SCALE to assess the quality of life of the patients you treat:

100%	No evidence of disease.
90%	Normal activity but signs or symptoms of disease present.
80%	Needing effort for normal activity.
70%	Totally independent, but unable to work or do normal activity.
60%	Requiring occasional help, but meeting most personal needs.
50%	Requiring considerable help, and needing frequent nursing care.
40%	Chair or bed-ridden, needing special care.
30%	Severely disabled, needing hospitalization.
20%	Disability complicated by severe sickness.
10%	Moribund.
0%	Deceased.

Before you start treatment, decide on your goal. Although a particular tumour may be curable, not all patients with it may be cured. Base your decision to treat a patient on: the stage of the tumour, the sites of its metastases, its particular histology, the state of his vital organs, his nutrition, the presence of other diseases, especially HIV, his willingness to accept toxic symptoms, and the staff and facilities you have to treat any complications he might get.

Use drugs only from the WHO list, and gain experience in their use. *Do not use them unless*:
(1) You know or are prepared to look up their general mode of action.
(2) You know their toxic effects and dangers, and have the necessary facilities to monitor these.
(3) You have decided what you are aiming for: cure or palliation?
(4) *You remember that an overdose can be fatal*. Even a normal dose can sometimes be fatal. Doses are usually given in relation to surface area, so have a table ready to relate this to height and weight. Carefully follow the rules about reducing the dose and stopping treatment when necessary. Remember that experienced doctors with compliant patients sometimes have disasters; for example, a patient can die from septicaemia in 48hrs.

If you do attempt cancer chemotherapy, you will have to know your limitations, and care for patients meticulously. Finally, do your utmost to see that a patient completes his course and is not abandoned. Either strive to provide a full course, or *do not attempt chemotherapy*. There is no justification for the idea, "let's just try a little cyclophosphamide".
Most cytotoxic drugs have their main action on rapidly dividing cells, which unfortunately include the cells of the bone marrow, the mucosa and hair. Malignant cells divide continuously, whereas marrow cells are quiescent for part of the time. Intermittent doses allow the marrow to recover, whilst maintaining an anti-tumour effect; but *do not wait so long that the tumour re-grows between courses*. A common regime is to give high intermittent doses over <24hrs, and to repeat them every 2-4wks.

You can often use cytotoxic drugs in combination because:
(1) They often act synergistically at different stages in cell division, or in different ways.
(2) Smaller doses can be used.
(3) If they have different toxic effects, their combined toxicity is minimized, because doses can be smaller.
(4) The tumour is less likely to become resistant.
However combined therapy is more expensive, and there may be more toxic effects, although each is less severe.

Tumour cells tend to multiply at a constant rate (37-6), depending on the proportion of cells dividing. Some grow very fast: Burkitt's lymphoma may double in size in 24hrs. Because of the constant rate of cell multiplication, a tumour grows exponentially, and its bulk increases more rapidly as it grows.

Similarly, chemotherapy kills a constant proportion of dividing cells, so that if it is sensitive, its size is also reduced exponentially. A large tumour may thus shrink rapidly to begin with, and then more slowly as it gets smaller.

Many cytotoxic drugs are very irritant indeed. If they extravasate into the tissues, they cause large necrotic ulcers.

N.B. If you inadvertently extravasate cytotoxic drugs, inject LA with hyaluronidase around the subcutaneous area affected, to dissipate the toxic tissue effects.

Infuse some cytotoxics, such as vincristine, dactinomycin, and doxorubicin, through a freely running IV line. Administer others by bolus IV injection with care! The IV route is usually better than oral, because high levels of the drug reach the tissues. Injecting irritant drugs into veins can cause thrombophlebitis. Over a long period, this can easily make all the accessible veins blocked. Try to insert a long cannula into a central or large peripheral vein, and bury it under a tunnel in the skin to prevent it becoming infected.

N.B. You can administer very few cytotoxic drugs IM.

Fatal complications of cytotoxic drugs are mainly septicaemia (80%), or intracranial haemorrhage (20%), from thrombocytopenia. Careful monitoring will minimize these dangers. You should only administer chemotherapy if the white cell count is >3/ml, and the platelet count is >150/ml It is risky, but may be justified, to use chemotherapy if the white cell count is between 2-3/ml and the platelet count between 100-150/ml; however, if you do not have powerful antibiotics, platelet transfusions or fresh blood, and especially if the disease is one with a small or no chance of cure, you may do a patient more good by withholding chemotherapy completely, until his white count and platelet count rise. Treating septicaemia is difficult, and may require all the antibiotics you have; bleeding may be catastrophic, and relentless.
Obviously, check if a female patient is pregnant before starting chemotherapy. In rare instances, you may need to sacrifice the foetus to save the mother. You may need to add non-hormonal contraceptive measures (to avoid venous thrombosis), and restrict breast-feeding.

DO NOT MAKE A PATIENT'S QUALITY OF LIFE SO POOR IF REMISSION IS BRIEF

WHICH CYTOTOXIC DRUGS?

Most basic regimes use either vincristine (expensive) or cyclophosphamide (fairly cheap), and usually both. The next most useful drug is methotrexate, which is fairly cheap in the low dose range used, where it rarely causes myelosuppression or damage to mucosal linings, and so does not require expensive folinic acid antidote rescue.
Other drugs are actinomycin D, chlorambucil, doxorubicin, melphalan and procarbazine.

MANAGEMENT

You will probably find it convenient to admit a patient beforehand for initial assessment and investigation, which must include a full blood count, pregnancy & HIV test, urea estimation and screening for liver disease; after the 1st course of chemotherapy, he can be discharged, and readmitted for each further course.

Be sure to deal with all treatable infections before starting chemotherapy. An infection which cannot be controlled is a contraindication to the use of cytotoxic drugs. A low-grade fever may quickly develop into septicaemia.

Establish a baseline, from which you can monitor the response to treatment weekly, and before each course of treatment.
(1) Monitor the clinical condition on the Karnofsky performance scale.
(2) Follow the size of the tumour, measured with a tape measure or ultrasound in two planes at 90º. If there is a lymphoma, or metastatic glandular deposits, count all the nodes and measure them with a tape. Assess the degree of involvement of any organs that are infiltrated.
(3) Watch for toxic effects, and infection, clinically at least 3 times wkly.
(4) Monitor the full blood count.
(5) Culture the urine.
(6) Do other tests as necessary, for example the blood urea. If there is a Hb <7g/dl before you start, transfuse with packed red cells, if necessary, repeatedly.
(7) Follow the weight.
(8) Assess the psychological state on a numerical scale.

INTRAVENOUS INJECTION
Oral chlorpromazine 25-75mg 1-2hrs before the injection will help considerably, by reducing nausea and vomiting. Further doses of this or other drugs, such as metoclopromide, cyclizine, haloperidol, domperidone may be necessary.
If you are administering chemotherapy by bolus IV injection, make sure you wear gloves to protect yourself, use sterile precautions and have all your material ready: adhesive tape in the proper lengths, an infusion set or syringe ready for use, and the drug already drawn up in a syringe and well diluted! Start with the distal veins and use them in rotation. Use the longest possible cannula and inject some saline to be sure that it is not blocked or dislodged. When you are sure, inject slowly over 10mins. If the cannula becomes dislodged, start again with a fresh one. At the end of the injection, flush the vein with 10ml of saline.

CAUTION!
(1) Use an absolutely clean technique: *do not touch the tip of the needle or the infusion set*. If you happen to contaminate them, discard them and use fresh ones.
(2) Infuse dactinomycin, doxorubicin, and vincristine into a free-flowing infusion.

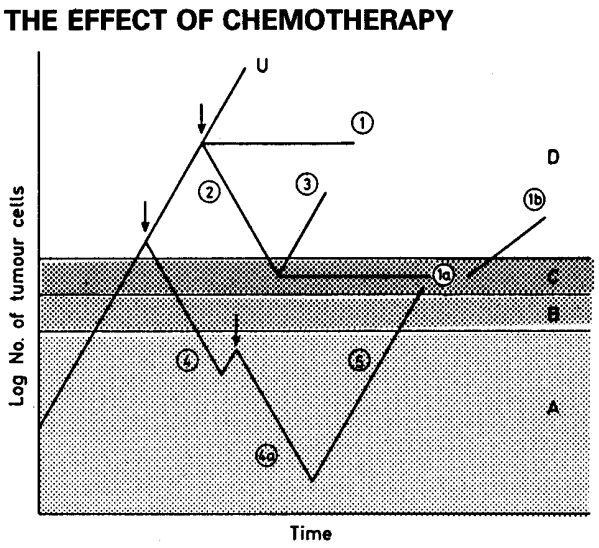

Fig. 37-6 THE EFFECT OF CHEMOTHERAPY on the size of a tumour cell population. A, B, C, and D, represent differences in a patient's clinical condition. In A, there is no evidence of a tumour. In B, it can only be shown by special laboratory tests. In C, there is radiological or clinical evidence of disease. In D, there are symptoms. The growth of the tumour untreated is assumed to be exponential (U). Three courses of chemotherapy (shown by arrows), at the same dose destroy the same proportion of tumour cells, whatever the total number of cells when treatment begins. In (2) the symptoms are relieved, but there are still clinical and radiological signs of disease. In (4) the symptoms are relieved, and all clinical and laboratory evidence of the tumour disappears. In (4a) treatment starts when the patient is apparently healthy.
After the effect of treatment has worn off, the tumour grows at the same rate as it did before. In (3) the symptoms return rapidly. After (4) further growth is arrested by course (4a), which delays the return of symptoms (5). Maintenance therapy, at a low dosage that sustains a steady state, does not relieve symptoms in (1) and does not cause any regression in (1a). Maintenance treatment is continued in (1b) but the tumour has become resistant to treatment.
After Galton DAG. Medical Aspects of Neoplasia, in Oxford Textbook of Medicine. OUP, Oxford 1983 Fig 1 p 4.93

ALKYLATING AGENTS
These damage DNA and so interfere with cell replication:

Chlorambucil 6mg/m² (max 10mg) orally od for 4-8wks.
Use for Hodgkin's lymphoma & ovarian cancer.

Cyclophosphamide 0·75-1·5m² IV every 7-10days.
Do not use if blood [urea] >17mM.
Use for non-Hodgkin's & Burkitt's lymphomas, breast cancer, teratoma.

Melphalan 10mg/m² orally od for 4days repeated 4-8wks.
Do not use if blood [urea] >17mM.
Use for myeloma, ovarian cancer.

CYTOTOXIC ANTIBIOTICS
These inhibit cell division, and form irreversible complexes with DNA. They also block DNA-dependent RNA synthesis:

Dactinomycin 2mg/m² IV bolus every 3wks (or, 1mg/m² on days 1 & 3) infused in a running IV infusion.
Use for paediatric cancers, teratoma.

Doxorubicin 50mg/m^2 IV bolus every 3wks infused in a running infusion. Reduce the dose in liver disease. *Beware cardiotoxicity. N.B.* Colours urine red.
Use for non-Hodgkin's lymphoma, acute leukaemia, breast cancer, Kaposi sarcoma.

ANTIMETABOLITES
These are incorporated into nuclei or combine irreversibly with cellular enzymes, preventing normal cell division:

Methotrexate 15mg/m^2 orally for 4days, repeated every 14th day. (30mg/m^2 wkly, IV if the blood [urea] <7mM.)
CAUTION!
(1) *Do not use methotrexate, if the blood [urea] >17mM* , because it accumulates when renal function is impaired.
(2) *Do not use it in the presence of an effusion (pleural or ascitic)*, because it accumulates in the fluid, and so stays in the body long enough to cause an overdose.
(3) *Do not use aspirin with methotrexate*.
(4) At high dosage, you must use folinic acid 15mg qid for up to 8 doses to counter the folate antagonist effect of methotrexate
Used for Burkitt's lymphoma (the low dose range), oral cancer (an intermediate dose: 40mg/m^2), nasopharyngeal cancer (high dose range: 150 mg/m^2), GTD (100 mg/m^2), breast cancer and teratoma.
N.B. This drug is also used for some inflammatory conditions, such as rheumatoid arthritis, or psoriasis.

5-Fluorouracil 500mg/m^2 IV od day 1&8.
Reduce dosage in liver disease.
Use for breast cancer.

VINCA ALKALOIDS
These act at the metaphase of mitosis and inhibit RNA synthesis: they are neurotoxic, resulting in peripheral paraesthesiae, loss of deep tendon reflexes *(e.g. foot drop)*, and cause ileus, abdominal pain and constipation.

Vincristine 1·4mg/m^2 (max 2mg) IV bolus weekly, infused in a running infusion. Reduce dose in liver disease.
CAUTION!
Use for all lymphomas, nasopharyngeal cancer, breast cancer, Kaposi sarcoma, teratoma, nephroblastoma.

MONOAMINE OXIDASE INHIBITORS
These antimetabolites cause DNA to fragment:

Procarbazine 100mg/m^2 od for 2-3wks. *Do not use if blood [urea] >17mM.*
CAUTION! Drug interactions may be a problem, especially with anaesthetic agents, phenothiazines, sympathomimetic drugs, alcohol and foods high in tyramine (fish and cheese).
Use for Hodgkin's lymphoma.

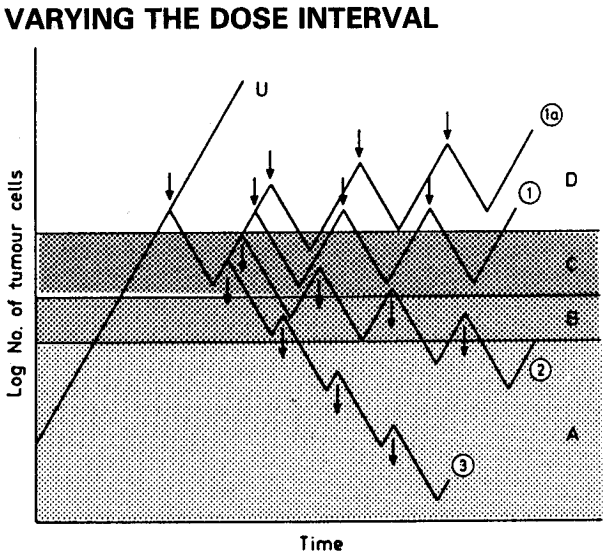

Fig. 37-7 THE EFFECT OF VARYING THE INTERVAL between courses of treatment, at the same dosage, on the size of a tumour cell population. The stages in a patient's clinical condition are the same as in 37-6. In (1), the interval between courses allows symptoms to return, but is short enough to maintain an essentially steady state. In 1a, the intervals are rather longer, and after the second course treatment fails to relieve the symptoms. In (2), the 2nd course begins before the return of symptoms, and the 5th begins when there are no clinical or radiological signs of disease, although the tumour can be shown by special tests. In (3), the intervals between courses are short enough to reduce the tumour cell population considerably.
After Galton DAG, Medical Aspects of Neoplasia in Oxford Textbook of Medicine, OUP, Oxford 1983, Fig 2, p.494.

37.5 Looking after the AIDS patient

The terminal care of the AIDS patient should be no different in terms of help and sympathy than the patient with cancer or other infectious disease. However, the HIV patient may suffer more with guilt, and social exclusion in certain societies. There may also be smelly wounds and fistulae. This situation becomes more complex when the relatives know the HIV status and the patient doesn't (or they do not think he does), or *vice versa*. Also the HIV patient is often much younger than the cancer patient, and may well not be ready to die. This is not necessarily more frequent with children. Such patients (and their relatives) ideally need the psychosocial support of a pastoral care team: if you are over-committed in a district hospital, you will face burn-out very quickly if you take on this work-load as well; *but you can organize so that others will.*
You should take precautions with dealing with the HIV+ve patient's secretions, blood and waste products. This also applies to wrapping up the dead body, and performing a post-mortem examination.
If, rarely, the deceased has not told his relatives of his diagnosis, you have an obligation to inform them of the true cause, because of possible HIV-transmission to the spouse and the various ramifications and consequences of this.

37.6 **Postmortem** (autopsy) **examination**

A post-mortem examination, also known as an autopsy, is a medical procedure that consists of a thorough examination of a body to determine the cause and manner of death and to evaluate any disease or injury that may be present. Even though you may not be a pathologist, you may find yourself needing to perform an autopsy. This may be for legal or medical purposes, especially when the cause of death is unknown or unclear. Sometimes an external examination suffices, but occasionally the body needs dissection and internal examination. You may require permission for internal autopsy in some cases; alternatively it may be demanded by the police or the courts. After completing an internal autopsy, you must reconstitute the body by replacing the organs which do not require histological examination and closing the skin. Post-mortems are important in clinical medicine as they can identify medical errors and assist in the improvement of care. A systemic review of studies of autopsies calculated that in c.25% of cases, a major diagnostic error is revealed. A large meta-analysis suggested that c.30% of death certificates are incorrect and that 50% of autopsies performed produced findings that were not suspected before death.
There are 2 main types of autopsies, forensic and clinical. There may be strong cultural objection to an autopsy, and you need to be guided by local laws and practice. However, many relatives are comforted to know exactly from what their loved one has died, especially if there is suspicion of foul play.

A. Forensic post-mortem
In 44BC, Julius Caesar was the subject of an official autopsy after his murder by rival Roman senators, and the physician's report noted that the second stab wound Caesar received was the fatal one.

The principal aim of an autopsy is to determine the cause of death, the state of health prior to death, and whether any medical diagnosis and treatment before death was appropriate. An autopsy is frequently performed in cases of sudden death, where completion of a death certificate is open to question, or when death is believed to be due to an unnatural cause. These examinations are performed under a legal authority and usually do not require the consent of relatives of the deceased. The most extreme example is the examination of murder victims, especially when medical examiners are looking for signs of death or the murder method, such as stab or bullet entry wounds and exit points, signs of strangulation or traces of poisoning.

Deaths are classified as:
(1) Natural,
(2) Accidental,
(3) Homicide,
(4) Suicide, or
(5) Undetermined.

B. Clinical post-mortem

Clinical autopsies serve two major purposes: to gain more insight into pathological processes and determine what factors contributed to a patient's death, and to ensure an adequate standard of care at hospitals. Autopsies can yield insight into how patient deaths can be prevented in the future.

There are 2 parts to the physical examination of the body: external and internal examination. Microscopy supplements these and frequently assists in assigning the cause(s) of death. Occasionally you need to request toxicology tests.
Make sure you wear gowns, gloves and a mask.
N.B. There is still a hazard of infection from HIV, hepatitis, Ebola and TB from post-mortems!

Identify the body by a hospital label secured to it.

C. External examination
After receiving the body, note the kind of clothes and their position on the body before they are removed. Next, collect any evidence such as residue, flakes of paint or other material from the external surfaces of the body. Then undress the body carefully, noting any tears in the clothing. Examine any wounds or lesions present and preferably take photographs, recording the sites. Generally, take 3 views: *overview, frame and close-up*, with a scale indicating sizes. Include the nametag if possible. Then clean, weigh and measure the body in preparation for the internal examination on a table in the autopsy room.

Make a general description of the body as regards ethnicity, sex, age, hair color and length, eye color and other distinguishing features (birthmarks, old scar tissue, moles etc). Use a standard examination form to record this information. In some countries, an autopsy may comprise an external examination only. This concept is sometimes termed ‘view and grant’. The principles behind this being that the medical records, history of the deceased and circumstances of death have all indicated the cause and manner of death without the need for an internal examination. This, however, is rarely likely to be the case in your situation.

If there is any injury to the body like gunshot or stab wounds, describe these carefully. Describe each individual wound, and locate its position on the body by distance (in cm) from the midline or a local landmark like the nipple, umbilicus or symphysis pubis. Describe the features of the entrance and exit wounds. Note whether any cavity is penetrated. If you find a foreign body *in situ*, state where and describe the nature of the object (*e.g.* calibre of bullet, knife). In instances where there are dozens of knife wounds, it might be necessary to handle them in groups: photographs are very helpful in this case.
Remember to look at the back! Beware that bruising may indicate how a body has been lying after death.

Look for generalized skin diseases, especially rashes or *petechiae.* Cherry-red skin or mucosa is a sign of carbon monoxide poisoning. Examine for localized deep burns, especially of hands and feet, suggestive of electrocution. If you see a black eschar, think of anthrax. Peeled off skin suggests burns, an epidermolysis (often HIV-related), or necrotizing fasciitis. Red-white-blue patches on the skin suggest hypo- or hyper-thermia. Animal bite marks are fairly obvious, but consider also human bites.

A body found late may show signs of serious decomposition. In this case, be very careful to look for any signs of penetrating injury because many other signs may be lost. In a case of drowning, try to establish if the deceased was alive before being immersed in water, by the finding of diatoms in intact tissues.
At this point, you may find that external examination is inadequate. You then need to proceed to internal examination, for which you may need special permission.

D. Internal examination

Place a plastic or rubber brick called a 'body block' under the back of the body, causing the arms and neck to fall backward whilst stretching and pushing the thorax upward to make it easier to cut open. This gives you maximum exposure to the trunk. The internal examination consists of inspecting the internal organs of the body for evidence of trauma or other indications of the cause of death.

Make a large and deep Y-shaped incision starting at the top of each shoulder and running down the front of the chest just lateral to the nipples, meeting at the lower point of the sternum. This allows maximum exposure of the neck structures for later detailed examination. The cut then extends all the way down to the pubic bone (making a deviation to the side of the navel). Use shears to open the chest cavity in order to allow the sternum and attached ribs to be lifted as one chest plate; in this way, you can see the heart and lungs *in situ* and avoid damage to the pericardial sac. Use a scalpel to remove any soft tissue still attached to the posterior side of the chest plate. Now the lungs and the heart are exposed. Set the chest plate aside, eventually to replace it at the end of the autopsy.

If there is a penetrating injury, examine the trajectory and assess the damage made. *You will not be able to prove the existence of a pneumothorax unless you open the chest under water!* Look in the pleural cavity for evidence of fluid: is it blood, pus or a simple effusion?
Remove the organs in a systematic fashion. Unless there is evidence of pathology or damage in the neck or lower thorax, divide the major mediastinal structures as high as possible, and likewise divide the aorta, inferior vena cava and oesophagus just above the diaphragm, and thus pull out the thoracic contents *en bloc*. Examine the heart-lungs-oesophagus specimen on the laboratory table.

Open the pericardial sac to look for a haemopericardium and view the heart. Open the pulmonary arteries to search for a blood clot (thrombo-embolus). Examine the lungs, particularly for signs of pneumonia (pus in the parenchyma), oedema (fluid oozing out on squeezing) and bullae on the surface. Open the trachea to look for thick secretions, or stomach contents (broncho-aspiration). Open the heart cavities in a coronal plane, and look at the heart valves, the thickness of the heart wall, and signs of infarction.

Examine the abdominal cavity to look for free fluid: is it blood, bile, ascites or pus? (You can test the fluid for protein or amylase if you are uncertain). Check for signs of organ perforation by gently squeezing the stomach, duodenum, intestines and gallbladder.

Look for penetrating injuries or haematomas from blunt trauma. Palpate the organs to determine if there is an obvious tumour, inflammation or adhesions. Look for signs of distended stomach, small or large bowel. Is the liver enlarged, cirrhotic, or mushy yellow (fulminant necrosis, *e.g.* due to mushroom poisoning); is the spleen enlarged?

Examine the abdominal organs systematically one by one after first examining their relationships and vessels. Carefully remove the liver (with the gallbladder), kidneys and spleen. Examine and weigh these organs and slice them to see if they are diseased.
Don't forget to cut the adrenals through. Inspect major blood vessels are cut them open if you suspect any pathology. Next examine the stomach and intestinal contents, which may be useful to indicate the time of death, from an understanding of the natural passage of food through the gastro-intestinal tract after ingestion.

To examine the brain, make an incision is made from behind one ear, over the crown of the head, to a point behind the other ear. When the autopsy is completed, suture the incision neatly so it is not noticed when the head is resting on a pillow in an open coffin. Pull the scalp away from the skull in two flaps with the front flap going over the face and the rear flap over the back of the neck. Then cut the skull with a saw to create a 'cap' that can be pulled off, exposing the brain. Look at the brain *in situ*. Then sever the brain's connection to the cranial nerves and spinal cord, and lift it out of the skull for further examination. Look at the meninges for a thickened cloudy appearance, suggestive of infection. Slice the brain, looking for oedema, infarcts, hydrocephalus, haemorrhage or tumours. You may only see damage at the level of the brain stem. Weigh the brain.

TAKE PHOTOGRAPHS OF RELEVANT FINDINGS

E. Microscopy

By making imprints or smears of different organs, you can confirm inflammation, tumour, or necrosis by cytology with use of Giemsa-stain even in remote clinics. If facilities for histology are available, the result is usually only available much later, and may not be useful for immediate purposes. Nonetheless you can cut open a tumour and get a pretty good idea if it is malignant, benign, or inflammatory (*e.g.* from TB) most of the time.

F. Reconstitution of the body

An important component of the autopsy is the reconstitution of the body so that it can be viewed, if desired, by relatives of the deceased following the procedure. After the examination, the body has an open and empty chest cavity with chest flaps open on both sides. It is unusual to examine the face, arms, hands or legs internally. All organs and tissue can be returned to the body unless any tissue is needed for further investigation. Place the organs in a cellulose or plastic bag to prevent leakage and return them to the appropriate body cavity. Place the body block that was used earlier to elevate the chest cavity to elevate the head, close the chest flaps and suture the skull cap back in place.

Clean the body surface thoroughly with water and a sponge to remove blood or excreta.

Remember you need to get consent in writing if you wish to preserve body parts for teaching purposes. Always record organs sent for forensic or pathological examination elsewhere.

G. Weights organs normal adult (75kg, norm +/-20%)

Lung: right	450 g
Lung: left	400 g
Heart	300 g
Liver	1500 g
Brain	1300 g
Kidney (rt or lt)	150 g
Spleen	150 g

H. Weights of normal organs of the Newborn at Term

Lungs	70 g
Heart	15 g
Liver	150 g
Brain	450 g
Kidneys	30 g
Spleen	10 g
Pancreas	5 g
Adrenals	5 g
Thymus	10 g

I. Checklist

Try to fit the diagnosis to the symptoms before death. The following are some causes of non-traumatic sudden death:-

Respiratory	Tracheal occlusion	Secretions, Foreign body, Laryngeal oedema, Strangulation/asphyxia, Goitre/neck tumour, Ludwig's angina.
	Pulmonary Failure	Pneumonia/TB, Pulmonary embolism, Tension pneumothorax, Haemothorax, Smoke inhalation, Pulmonary contusion.
Vascular:	Haemorrhage	Trauma, Ruptured ectopic gestation, Ruptured aneurysm, Bleeding peptic ulcer, Bleeding oesophageal varices, Intestinal haemorrhage, Uterine haemorrhage.
Cardiac	Cardiac Failure	Myocardial infarction, Cardiomyopathy, Cardiac rupture, Cardiac tamponade, Aortic dissection.
Cerebral	Cerebral Failure	Cerebral haemorrhage, Cerebral infarction, Cerebral oedema, Meningitis, Pre-eclampsia.
Renal	Renal Failure	Pyelonephritis, Glomerulonephritis.
Adrenal	Adrenal Failure	Haemorrhage, Infarction, Anaphylaxis.
Peritoneal	Peritonitis	Sepsis, Intestinal volvulus, Pancreatitis.
Gynaecological	Uterine failure	Sepsis, Rupture.
Sepsis	Septicaemia	Necrotizing fasciitis, Gas gangrene, Tetanus, Other sources.
Toxins	Toxaemia	Poisons, Venoms.