科技资料

Drug Delivery in Cancer Treatment III

L. Domellöf (Ed.)

Drug Delivery in Cancer Treatment III

Home Care –
Symptom Control, Economy, Brain Tumours

With 34 Figures and 38 Tables

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Foreword

The European School of Oncology came into existence to respond to a need for information, education and training in the field of the diagnosis and treatment of cancer. There are two main reasons why such an initiative was considered necessary. Firstly, the teaching of oncology requires a rigorously multidisciplinary approach which is difficult for the Universities to put into practice since their system is mainly disciplinary orientated. Secondly, the rate of technological development that impinges on the diagnosis and treatment of cancer has been so rapid that it is not an easy task for medical faculties to adapt their curricula flexibly.

With its residential courses for organ pathologies and the seminars on new techniques (laser, monoclonal antibodies, imaging techniques etc.) or on the principal therapeutic controversies (conservative or mutilating surgery, primary or adjuvant chemotherapy, radiotherapy alone or integrated), it is the ambition of the European School of Oncology to fill a cultural and scientific gap and, thereby, create a bridge between the University and Industry and between these two and daily medical practice.

One of the more recent initiatives of ESO has been the institution of permanent study groups, also called task forces, where a limited number of leading experts are invited to meet once a year with the aim of defining the state of the art and possibly reaching a consensus on future developments in specific fields of oncology.

The ESO Monograph series was designed with the specific purpose of disseminating the results of these study group meetings, and providing concise and updated reviews of the topic discussed.

It was decided to keep the layout relatively simple, in order to restrict the costs and make the monographs available in the shortest possible time, thus overcoming a common problem in medical literature: that of the material being outdated even before publication.

Umberto Veronesi
Chairman Scientific Committee
European School of Oncology

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Introduction

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Drug delivery in cancer treatment has emerged as a distinct and interdisciplinary, if hybrid, topic for one of the task forces of the European School of Oncology. We are now happy to present to our readers the third ESO Monograph with the unifying objective of delineating the research frontiers in pain relief, drug therapy and nutritional support.
In the present monograph, we have extended the objective more specifically to encompass drug delivery in home care. We have also involved health economists in the task force in order to focus cost assessments of cancer treatment alternatives. This is of immediate importance today when in most countries health-care budgets are rapidly cut down. By this approach, we hope to vitalise discussions on how to use home care as part of our future treatment strategies.The first chapter of this monograph deals with home care in the European perspective. Only recently have we changed our attitude in oncology from practically uniform hospital care to individualised treatment at home or in home-like settings. It is important to emphasise that outpatient clinics, pain relief centres, hospices and home care teams form a network that is more or less established in different countries. The development of these new programmes requires planning of reimbursement, availability of resources and education.

In the second chapter, the importance of simple and effective therapeutical strategies are presented in order to control advanced cancer, and drug-related symptoms. Examples are dyspnoea due to pulmonary parenchymatous lesions and/or pleural effusion, infection, oral cavity complications, gastrointestinal disorders, nutritional and mental problems. Models for new palliative home care units are presented as well.

Next follows a discussion on the present role of home parenteral nutrition (HPN) in progressive cancer malnutrition. Moderate or intense nutritional support seems to decrease the protein breakdown and HPN is of demonstrable palliative benefit in selected cancer patients, reducing the need for hospital care. HPN including vitamins and trace elements may improve the quality of life in the terminal phase of cancer, or during periods of intensive chemotherapy.

In the following chapter, new technologies for therapeutical drug monitoring in oncology are presented. It is well known that the dose of a cytotoxic drug is often the critical factor in the success of cancer chemotherapy. At present, we lack the basic pharmacokinetic knowledge of most anticancer drugs. Consequently, a broad pharmacokinetic population data base including background variables to the interindividual diversity could make a feedback for drug dosage optimisation possible, simply by using 2 plasma concentration determinations from samples taken at short time intervals. When developed, this technique should facilitate cytotoxic drug administration to outpatients and in home care. The development of medical technology and new treatment models have an economic impact, and it is mandatory to make economic assessments at an early stage. It is remarkable that valid economic studies of cancer treatment costs are very rare, or even non-existent.

Today, when we are faced with a number of effective treatment alternatives, they should be evaluated by the cost analyses which are necessary for rational treatment choices. This can also be clearly seen from a German mobile home-care project which offers drug delivery at home, administered by specially trained personnel. This pilot project has shown a reduction of treatment costs of about 40%.
It seems reasonable for health economists to be involved in similar projects, in order to obtain general acceptance of home care as an alternative for cancer patients with advanced stage of the disease.

The final chapter gives an excellent introduction to the pathophysiology and the background of ongoing research in drug delivery to brain tumours. Primary and secondary brain tumours are frequent and represent a challenging treatment model, also valid for tumours of other locations.

We hope that this third monograph will familiarise the interested physician with concepts and information that are widely dispersed in the medical literature. It is anticipated that the experience gained through the compilation of these 3 monographs can be of value in ESO-seminars and may contribute to the evolution of later monographs.
The editor has greatly enjoyed planning and chairing the task forces and wishes to thank the contributing authors for their diligence, promptness and cooperation.

We all acknowledge the excellent help of the ESO-staff in arranging the meetings and in preparing the monographs. We extend our thanks to Pharmacia for promoting this multidisciplinary monograph through their generous support.

Perspectives in Home Care

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The amount and the quality of care which a society spends on its elderly and disabled members is a reflection of that society's standard of civilisation. This care intends to increase the quality of life, to cure or to palliate. For patients with cancer, cure rates have gone up, thanks to improvements in surgical skills, better radiotherapy and, to a lesser degree, the improved administration of cytostatic drugs. However, for the majority of patients with cancer, cure is not possible. As the prevalence of cancer increases with age, and as the number of elderly people increases rapidly, a considerable part of the care will be devoted to patients with incurable cancer. It is particularly evident that in this group of patients for whom a vast array of anticancer treatments is available, dilemmas will arise as to whether one should initiate or stop such treatments. The benefit is often doubtful or "marginally useful" [1]. They are responsible for many side-effects, unrealistic expectations of regaining former vitality and frequent hospitalisation. Furthermore, this therapeutical attitude contributes a great deal to the rising costs of medical intervention. The ever-increasing expenditure for medical care has made it clear that our resources are limited; consequently, in the near future, difficult choices concerning the adequacy of medical intervention have to be made. These financial restraints are probably the main reason for promoting the concept of home care.

A second factor is the change that hospitals have undergone. The unprecedented growth of medical technology and the cuts in the number of hospital beds have generally turned the hospitals into efficiently run institutions for treatment, with the accent being more on cure than on care.

Patients with incurable diseases and their families are, therefore, more inclined to prefer alternatives providing care and more privacy. With modern technology adapted to the home situation and well organised nursing facilities, the care that is needed can be given at home. There is a renewed and changing interest in the responsibility towards the care of patients with advanced disease and in the support of the dying [2,3]. Factors of this renewed interest in relation to home care are: a change in attitude towards medical intervention, a better understanding of the curative treatments and their limitations, an increase in the numbers of old people, limits to financial resources and improved technical equipment adapted to the home care.

Changes in Therapeutical Attitudes

For a long time, hospitals have been the only accepted care alternative for medical treatment of cancer patients. Originally, this meant palliative treatment in most cases with cures for only a minority of the patients. Advances in biomedicine have greatly increased the effective treatment possibilities, along with a fast decline in morbidity and mortality. These advances have resulted in a gradual reduction of the possibilities in providing long-term care in hospitals; a change that has been negative for the ill and disabled. The emphasis is now more functional than supportive. It is obvious that for patients with advanced cancer and patients who are dying, different standards are needed.

The marked political and economic support of health care has, surprisingly enough, not been accompanied by general improvements in the subjective feeling of healthiness and physical well-being. This is what Barsky calls "the paradox of health" [4]. In this noteworthy article, he asks why so many people experience a subjective uneasiness in well-being today in spite of so much health care? Several factors explaining this paradox are mentioned.

1. The lowered mortality rate of infectious diseases has resulted in an increased prevalence of chronic disease such as cancer.
2. The awareness of health, leading to a greater self-scrutiny and increased awareness of bodily symptoms and feelings of illness.
3. The commercialisation of health and the focus on health issues in the media have induced a climate of alarm and hypochondria, undermining feelings of well-being.
4. The medicalisation of daily life has made it possible to relieve many distressing conditions. However, it also leads to unrealistic expectations of curing any ailment. Refractory symptoms and residual impairments are therefore considered as a failure of medical care.

Although Barsky makes his comments in respect of the situation in the USA, the same trend is evident in the rest of the Western world. There is a growing notion that modern biomedicine cannot cure everything and that the cure potentials for chronic diseases are limited.

Limitations of the Present Curative Potential

The idea that for every ailment there should be a solution led to "the war on cancer" in the USA in 1971 [5]. After years of enormous effort to conquer the cancer problem, resulting unfortunately in fewer cures than hoped for, the attitude among cancer specialists is now more modest. Attention has focussed on basic research whilst, at the same time, efforts are being made to treat patients as well as possible.

Surgeons and radiotherapists have learnt what their therapeutical limits are. Reasonable concensus has been achieved on when to intervene for cancer patients and when to stay away. Chemotherapists find it more difficult to decide when to initiate and when to stop therapies that are considered as "marginally useful" [1].

In a study of acutely ill cancer patients, Silverman concluded: "a disproportionate amount of intervention was done on patients who eventually expired. It seems evident that efforts directed at reducing costs and increasing efficiency must be focussed on this high-risk, high-cost, low-yield group" [6]. Holli and Hakana assessed the intensity and the changes in diagnostic investigations and treatment in 519 patients with breast cancer in the terminal stage. In those patients who died within one week of the last visit to their physician, 2.6 times as much chemotherapy had been given as compared to the patients who survived with recurrent disease [7].

The question of whether to offer anticancer treatment during the late stages of a disease is a very complex one for the clinician. It is like the decisions regarding intensive care patients: "simple (...) solutions, such as witholding resources from the hopelessly ill (...) are difficult to apply to an individual patient because prognosis is always uncertain" [8]. In England, a working group of cancer physicians, epidemiologists and health economists have tried to answer 2 questions: "Is unfettered clinical freedom appropriate in the management of patients with cancer?" And: "Is consensus possible on what is appropriate and inappropriate care for patients with cancer?" This working group recommended that consensus statements, set out by an expert panel, should be distributed to the medical profession, and that the savings achieved by rationalisation of cancer management should remain available for reallocation to other areas of cancer care [9].

Increase in the Number of Old People

The general health status in the Western countries is excellent, although not evenly distributed. The total population of the countries in the Organisation for Economic Cooperation and Development (OECD) was nearly 780 million in 1980 [10]. The percentage of the population aged 65 years and older was 12.2% or 95 million. The aged part of the population dependent on the productive part of the population, expressed as the ratio of those aged 65 years and over to those aged 15-64 years, is 18.8%. This ratio varies from 8.2% in Turkey to 25.2% in Sweden. Life expectancy in the OECD countries has increased substantially during this century. The mean life expectancy at birth for males in all OECD countries was 48.0 years in 1900, but in the 1980s it had risen to 71.0 years. For females, these life expectancies were 50.6 years in 1900 and 77.7 years in the 1980s. At the age of 65, the corresponding life expectancy for males was 11.1 and 14.0 years, and for females 11.9 and 17.9 years. These increased life expectancies are due to a decline in mortality rates, in particular due to a decline in infant mortality and acute infectious diseases. The modest increase in life expectancy from the age of 65 years, compared to the increase from birth, reflects the limited possibilities for treatment of chronic degenerative diseases.

The age-standardised death rates (per 100,000 population in the 1980s) in the OECD countries is mean 855 (males 1114 and females 633), with a range of 542 for females in Switzerland and 1359 for males in Luxembourg. The mean age-standardised death rate for malignant neoplasms, after cardiovascular diseases the second most important cause of death, is 197, for males 260, and for females 155 per 100,000 population. The range here varies from 114 for women in Greece to 373 for males in Luxembourg. These numbers are likely to increase in the future, with a calculated age-dependency ratio in the OECD countries from 18.8 in 1980 to 22.9 in 2010 and 33.3 in 2030. These changes could have a substantial impact on health spending.

In his original article, Fries contradicts this conventional anticipation of an ever older, more feeble and ever more expensive-to-care-for population [11]. He states that the length of life is fixed, man is mortal and natural death may occur without disease. The average length of life has increased, however, with chronic disease superseding acute disease. This results in a "rectangularisation" of the survival curve, most of the deaths occurring around the fixed age of 85. The author argues that chronic diseases could also be postponed by stimulation of physical, psychological and social activities in the elderly, thereby preventing premature organ dysfunction. This may lead to a "rectangularisation of morbidity" or a "compression of morbidity" (until shortly before death). This concept of a vigorous life with a decline in strength during a short period before the end of life, demands a different attitude towards the elderly. "They require opportunity for expression and experience and autonomy and accomplishment, not support and care and feeding and sympathy". At the end of life, when all the resources are used up, medical technology should be avoided. Human interaction, in other words care, is what is needed in this last period of life.

Financial Limits

The spending on health care in the Western countries is enormous. In 1970, the USA spent $75 billion on health care, in 1986 $465 billion [12]. In the OECD countries, the ratio of the total health expenditure and the gross domestic product (GDP) rose from (mean) 5.8 in 1970 to 7.5 in 1984. The ratio in 1984 varied from 4.6 in Greece to 10.7 in the USA [10].

Moreover, there is a concentration of health expenditure on relatively small numbers of individuals: the aged, persons in their last years of life and patients with heavy prior use of services. In the USA, the Medicare programme in 1982 delivered 32% of its expenditures to 2% of the population served. On the other hand, 39% of the population eligible for the Medicare programme did not receive any paid service during that year. In the OECD countries, the per capita health spending on those aged 65 and over is 4 times the amount spent on people under 65 years old.

It is obvious that the rise in spending on health care cannot go on. The authorities responsible for health-care management have reacted with stricter rules varying from budgets for hospitals to payments for disease-related groups, thereby limiting the amount of money hospitals receive per diagnosis. As a result, pressure is exerted for an earlier discharge of patients and more efficiency in hospitals, leading to diminished opportunities for the personal needs of the patients to be attended to. Against this background, it is not surprising that the idea of treating patients at home and in hospices has been well received everywhere. It has not been shown, however, that home care leads to less health expenditure. Studies on this subject are conflicting. For many patients, hospital admissions are necessary during the period of home care and there is sometimes overlap of care-giving organisations. Particularly in the USA, home care is to a great extent provided by commercial companies [13]. The interests of these companies are not necessarily the same as those of the patients needing the care. Problems of overuse and fragmentation of services are possible, with care being more accessible to the affluent members of society and to a lesser degree to the less endowed [14].

For detailed information about finances in home care, the reader is referred to the chapter "Economic Evaluation of Cancer Treatments" in this monograph.

Improved Technical Equipment

The development of venous and arterial access devices, implantable and portable pumps, have brought treatment into the homes of the patients, where in earlier times these treatments would only be administered in hospitals. Furthermore, improved technology, from simple alarm systems to complicated respiratory support machines, is available for home care. Later in this chapter, more details about the drug delivery devices will be given. See also the chapter in the first monograph of this series: "New Technical Developments in Antineoplastic Drug Delivery and Their Role in Cancer Treatment" [15].

To conclude this section about renewed interest in home care: the elderly and dying patients will benefit most from home care, but the standards of care must be adapted to their needs, bearing in mind our limits in cure potential, the marginally useful therapies often causing considerable suffering from side-effects. In the context of these limitations, statements such as: "it is a modern and ignorant prejudice to consider death a failure" or "dying is the natural consequence of living" are understandable [16]. There is a growing belief that dying patients wish to spend their last days at home. In their own surroundings it is easier to maintain their autonomy and decide what treatments are warranted in the light of a better quality of the rest of their lives. At home the quality of care comes first, and when it is given in the right way, with the omission of unnecessary treatment, a cost reduction will ensue.

Home Care

Delineation, Growth, Problems

Home care can be defined as: "the provision of equipment or services, either medical or of a social support nature, to patients in their places of residence, for any of a variety of reasons" [17]. In this definition, no mention is made of the prognosis of the patients: their illness may be curable or incurable. Until now in this review, home care has only been considered in relation to the care for the terminally ill. They are the majority who are eligible for home care. Patients with potentially curable cancer can, however, from time to time very well have their treatments at home. Home care can be given with a curative or palliative intent. Curative treatment at home for cancer patients includes anticancer treatments, often delivery of cytostatic drugs with all the support such treatment requires. But also patients recovering from surgical procedures or radiotherapy can be cared for at home. This is what Parkes calls "active treatment" [18]. The care is given for a limited time period, after which recovery, including resuming one's normal activities, is expected. Palliative care can be terminal, supportive, pain relieving or even specific oncological care, depending on what is most needed by the patient. In practice, such sharp distinctions are not possible. Often combinations of these forms of care are involved. Specific oncological care can also be given for palliative reasons.

Schematically:

Home care
- *curative care*
  - active treatment
  - e.g., anticancer treatment
- *palliative care*
  - terminal care
  - supportive care
  - pain relieving care
  - specific oncological therapy

The terms "terminal illness" or "terminal period" should be used with caution. Nevertheless, in defining and accepting this concept of terminal illness or period, we can probably find the key problem with regard to the proper care of those with incurable cancer.

Both Bayer and Hadlock mention difficulties in defining the concept, such as difficulties in making a good prognosis, no physiological measurements available, the occurrence of occasional surprise recoveries and the clinical imperative to maintain patient's hope [1,19]. McCusker defines the terminal period as: "the period during which there is evidence of progressive malignancy, and in which therapy cannot realistically be expected to prolong survival significantly" [20]. And Bayer: "... an illness in which, on the basis of the best available diagnostic criteria and in the light of available therapies, a reasonable estimation can be made prospectively and with a high probability that a person will die within a relatively short time" [1]. And Parkes: "that period from the end of active treatment to the patient's death" [8]. This last definition does not take into account the fact that the end of the active treatment period is often rather arbitrary, depending on when the patient and doctor give up hope of a cure. Moreover, some patients for whom no active treatment is available, are already in the "terminal period" as soon as the cancer diagnosis has been made. The essence is given by Bell, who states: "the criterion that distinguishes palliative care is that death is the expected outcome rather than prolonged life...." [21].

All definitions remain vague, without any exact measurements. Saunders has a practical attitude, emphasising that there is a period of overlap between active and palliative treatment [22]. During this overlap period, the focus of care shifts from control of the tumour to control of symptoms. With proper control of symptoms, it is indeed sometimes possible to reconsider further treatment aimed at prolonging life. There is no strict boundary between the 2 approaches.

The concern about the concept "terminal illness" or "terminal period" stems from the anxiety that a worthwhile active treatment may be missed or overlooked. Furthermore, it may be easier for some caregivers to go on with active treatments, fearing otherwise that the patients will be deprived of any hope left for improvement of their ailments.

The tendency of third-party payers and managers to pose limits on the "allowed" duration of the terminal period of cancer patients to be eligible for home care, must be criticised. It is not acceptable that patients may be forced to spend their last days in a hospital, solely because of difficulties in payment for care at home. In connection with this problem, it is remarkable that studies on the duration of the terminal period give very similar results as to the median duration: from 29 to 65 days, with rare long survivals of 2 years (Table 1).

The realisation that the terminal period has come may give some relief to both patients and caregivers. They can allow themselves time for reflection, and needless harm due to anticancer treatment can be avoided. All efforts can be spent on good palliation and the rest of their lives can be more humane.

The development of home-care programmes is related to the hospice movement. Dame Cicely Saunders was the first to set an example of how patients in the last stages of their disease should be cared for. She founded St Christopher's Hospice in 1967. From there, her ideas about caring for the dying have spread throughout Europe. The care offered includes palliation, especially pain relief, support also for the patient's relatives and bereavement care. As long as possible, the care is given in the patient's home,

Table 1. Duration of terminal illness

Author	Type of Study	Type of Care	No. of patients	survival (days)		
				median	mean	variation
McCusker [20]	retrospective	not specified	(144) eval.:125	45	94	1-1320
Kane [23]	randomised prospective	hospice/ hospital	137/110	65*	-	several days 660
Vinciguerra [24]	prospective non randomised	home/hospital	174/ 44	48 29	- -	several days 475
Hadlock [19]	retrospective	home	370**	30	67	1-685
Parkes [18]	retrospective (only patients under 65 years)	home/hospital	(276) eval.:235	63***	-	2 survived > 2 years

* Median derived from graph. One-third of patients died within 45 days; two-thirds of patients died within 120 days = no statistical differences between the study arms

** In this study, there were 370 patients with cancer of a total patient population of 385

*** One-third of the patients died within 28 days; two-thirds of the patients died within 105 days

with the possibility of (re)admission to the hospice nearby and even hospital stand-by facilities in case medical intervention for a good palliation is needed. The organisation, therefore, must be flexible. This ideal situation is not yet possible everywhere because of administrative and financial problems.

The initiative to start home-care programmes is being made by hospitals, communities and commercial companies. Home care is offered in a variety of forms and quality. There are well equipped organisations with the accent on technology and more modest ones with a staff of volunteers. It was a principle from the beginning that a large part of the work should be done by volunteers, in order to "demedicalise" the care. Care requiring special technological skills is mainly done by, or at least supervised by, professionals. Home care asks for a multidisciplinary approach. The idea has flourished especially well in the USA: in 1974 the first hospice, and in 1985 1400! This popularity in the USA is probably related to 2 facts, the loose family ties and the falling into disuse of house calls by physicians. In England, hospices with home care extensions relying largely on volunteers are widely diffused. Generally, hospices are more common in the northern parts of Europe than in the southern areas; again, this must be regarded in relation to the still existing close family ties in the Mediterranean countries.

Problems in establishing and maintaining home-care programmes are of a financial and educational nature. In 1983, legislation was approved in the USA whereby hospice services were covered by Medicare. Third-party payers are, however, still reluctant to pay for home care, although this is gradually changing. The problems of overuse and uneven distribution among the members of a society are difficult to control in commercially launched programmes. In many European countries, social and private insurance organisations make strict distinctions between the costs of care at home and those in the hospitals. The concept of a hospice does not fit into these models, thereby preventing a flexible care programme between the home, the hospice and the hospital.

As a consequence of the reimbursement of costs for home care, the problem of setting standards arises. With only general standards, too high for simple organisations or not rigid enough for very sophisticated programmes, it may turn out that home care is hard to maintain.

Education is a major concern in home care. Continuous education and instruction are needed for the patient, family, district nurses and volunteers. Education, information and propaganda are also required for the authorities. The person who is often surprisingly misinformed is the doctor [17]. Where technology from the hospital is applied within the domain of the general physician, doctors feel insecure. Reasons for this are probably: insufficient education at medical school in the care of the terminally ill, domination of technological interests and the complexity of the organisation of home care. Adaptions of the curricula in medical schools and postgraduate training are urgently needed.

Drug Delivery at Home

Conditions, Practice

The continuing increase of patients with cancer who are treated on an outpatient basis necessitates greater home-care skills by patients, their families, nurses and doctors. A sizeable body of literature suggests that home-care services can have a major impact on health care [25]. For example, home health care is often the best form of health care for individuals at specific stages of recovery. It provides the needed transition between the hospital and the home situation at considerably less cost than if the patient remained in the hospital. Inconsistent results in cost-effectiveness studies indicate the need for additional research in this area, targeted specifically to identified population groups, such as cancer patients.

Disparity of needs between the patients and the caregivers was consistently found in several studies [26].

Studies on cost-effectiveness, assessment of patients' needs, and quality of care and of life should be the valid concern of all health care providers (home and hospital); these evaluations play a major role in the provision of quality care in the hospital, as well as in the home situation.

Home Care Is not Suitable for Every Patient with Cancer

Selection of patients/candidates for home care:

1) cancer patients with advanced disease, defined as disease that is metastatic and incurable but not imminently terminal [27];
2) cancer patients whose treatments impose self-care deficits (either temporary or long term), such as individuals with colostomies, laryngectomies, or individuals receiving total parenteral nutrition;
3) cancer patients who experience the effects/side-effects of the treatment, for instance altered skin integrity, due to radiotherapy;
4) cancer patients with advanced disease, who are terminally ill.

Of utmost importance in determining whether a person is eligible for home care is the question of whether the care provided can be classified as "skilled". Skilled nursing care has been interpreted as being not only those technical procedures directly rendered to the individual, but also patient assessment and evaluation, management of a prescribed medical regimen, and patient teaching [28].

An important factor for the potential success of home care is the organisation: the availability and type of formal home health services to assist in the supervision, management and supply of technical equipment.

Home Care, Technology and Drug Delivery

Practical considerations, problems

The major conclusions of a report of the Dutch Selecting Committee on Future Scenario's Health Care suggest:

1) an urgent problem in the organisation of medical home care is the lack of clarity with regard to responsibilities;
2) professional home health-care providers need specific education and, especially, orientation towards available and future technology;
3) special attention should be paid to the relationship between patients and the available equipment (patient-machine interface) [29].

Drug delivery at home

The main advantage of drug administration at home for the patient is obvious: no need for hospital admission, and the fact that the patient stays in his own safe surroundings. The indications for drug delivery at home can differ per individual cancer patient, but are mainly focussed on:

1) administration of analgesic drugs, intravenously, subcutaneously or intrathecally;
2) parenteral nutrition;
3) administration of chemotherapy or immunotherapy.

Drug Delivery Systems

For the continuous administration of drugs, or parenteral feeding, intravenously central venous catheters are a necessity, especially in the home situation, in order to guarantee optimal comfort of the patient. The access devices used can be subdivided into external and totally implantable catheters [15,30,31].

External catheters:

1) the short-term (subcutaneously, not tunnelled) catheter, sutured in place;
2) the long-term venous catheter, tunnelled subcutaneously with a dacron cuff. This allows embedding into the subcutaneous tissue and stabilisation of the catheter, and minimises the risk of ascending infection (Hickman catheter).

The main principles of management of one of these catheters consist in using a strict aseptic technique and maintaining patency of the system by regular flushing procedures and care of the exit site. The main disadvantage of these types of catheters is the risk of infection.

Implanted ports and reservoirs

A vascular implanted port is a catheter attached to a reservoir (port) which is surgically implanted subcutaneously, usually in the anterior upper chest wall. The catheter is tunnelled and inserted into the vein. Assessment of the system is carried out with special Huberpoint needles. The aseptic technique should be used in managing these ports.

The main advantage of this system is that there is less chance of contamination, and it is cosmetically more acceptable for the patient.

For the use of epidural catheters, see the chapter written by Ventafridda et al. [40].

To deliver drugs safely at home, it is necessary to use reliable, accurate, easy-to-use infusion pumps [32]. Many different pumps are available at this moment, both implantable and external, portable pumps. The advantage of an implantable pump is that nothing is visible on the patient's body; however, there are a few important disadvantages: the pump must be implanted under total anaesthesia, there is less flexibility in dosage adjustments, the pump can be used for one individual patient only and is expensive.

The external pumps are available in 3 different kinds:

1) pumps with syringes;
2) peristaltic pumps with reservoir (on batteries);
3) balloon pumps.

The syringe pump is relatively cheap to purchase and to maintain. It is also fairly easy in terms of patient education.

The peristaltic pumps are more expensive to purchase, due to the need for special reservoirs and tubings.

The balloon pump, in which an elastic filled balloon acts as an energy source, is suitable for use once only. It has a set infusion delivery time, does not have an alarm system, and is relatively expensive.

The care of patients with venous catheters attached to pumps is complex, and numerous controversial issues surround the care of these devices. Although much research is in progress, current study results have not conclusively solved these practical issues.

The safe delivery of drugs at home is dependent on several factors:

- the skills, competence and qualifications of the professional caregivers involved;
- the support of the hospital from which the treatment was implemented (24 hour on-call service);
- delegation of responsibility to either the hospital physician, the general practitioner, the nurse, or the patient;
- training and education of the professional caregivers involved, nurses and doctors, the patient and his relatives, with regard to the devices, side-effects and complications;

- distance between the hospital and the home;
- psychosocial support for the patient and his relatives.

Drug delivery at home is feasible, but one still has to deal with several problems. A consensus over the components of good home care organisation should receive high priority in all countries, in order to prevent social differences in care services, which already exist in some places. These differences are partially caused by the unstructured creation of private health care agencies.

The main goal of all efforts undertaken should be the well-being of the patient. A clash of interests of the different home healthcare providers should be avoided at all costs.

Studies on Home Care

In this section, a selection of studies on home care will be briefly reviewed. They are divided into:

- general studies, trying to answer questions about quality of care and expenditures;
- studies on pain experiences;
- specific studies on applications of the drug delivery devices in the home situation. The 3 subjects - delivery of chemotherapy, nutritional support and symptom control - are presented in more detail in separate chapters of this monograph.

General Studies

Kane et al. carried out a randomised study of hospice care [23]. They compared the care given to terminally ill patients in the hospice, which was based at the Veteran Administration Medical Center in Los Angeles, a university-affiliated teaching hospital, to conventional hospital care. The hospice care was provided in the hospice, but also at home. The study included 137 hospice patients and 110 hospital patients. No significant differences were found between the 2 groups in measures of pain, symptoms, activities of daily living or affect. The hospice patients expressed more satisfaction with the care they received. Hospice care was just as expensive as conventional care.

In the National Hospice Study (USA), the same items were investigated [14]. In the aspects: activities in daily living, functional performance, emotional quality of life, overall social quality of life and patient's satisfaction with care, no difference was noted between hospice and conventional care.

Vinciguerra et al. compared prospectively the care for non-ambulatory cancer patients at home and in the hospital [24]. A multidisciplinary team, including an oncologist, an oncology nurse, a social worker, a dietitian and a medical technologist, went to patients' homes in a medically equipped van. The study was not randomised. Patients being treated in the hospital were comparable to those in the home-care group, except for age differences: the hospital group included more people under 50 years, and the home patients had more gastro-intestinal cancer. There were 174 patients in the home group and 44 in the hospital group. Many patients were still receiving antineoplastic chemotherapy at the time of entry to the study: 27% of the hospital group and 29% of the home group. The home group had a decreased requirement of narcotics expressed as average daily morphine equivalent dose, and a decreased hospitalisation compared to the hospital group.

Hadlock described an independent hospice home-care programme in Southern Florida [19]. This article gives a wealth of data about patient characteristics and organisational details. It gives no measurements of the quality of the services provided. Three hundred and eighty-five patients were described, 370 of whom had cancer in an advanced stage. Seventy-four percent of the patients were 65 years or older. On entry into the programme, there were 5.8 symptoms on average per patient. Whilst on home care, an additional 3.2 symptoms per patient developed. In 88% of the patients, pain was one of the symptoms, but pain accounted for only 10% of all the symptoms. Gastro-intestinal symptoms were the most prevalent with 19%. In this aged population, there were multiple secondary diagnoses: 2.5 per patient. The average stay in the programme was 66.2 days. The members of the team, the nurses, nurse aides, physicians, social workers, volunteers and