

Work-up times in an integrated brain cancer pathway

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ABSTRACT

INTRODUCTION: The integrated brain cancer pathway (IBCP) aims to ensure fast-track diagnostics and treatment for brain cancers in Denmark. This paper focuses on the referral pattern and the time frame of key pathway elements during the first two years following implementation of the IBCP in a regional neurology department.

MATERIAL AND METHODS: All patients (n = 241) enrolled in the IBCP during the two-year period were included. Times from admission to completion of the key elements of the IBCP were used. The referral manner and changes in total neurology work-up time over eight quarters were assessed.

RESULTS: The monthly patient enrollment decreased over the eight quarters studied. Primary care physicians accounted for nearly half of referrals, while one-third were referred from other hospital departments. The mean time from admission to end of diagnostic work-up fell from three days (0-10 days) to two days (0-6 days). Within 24 hours of admission, all patients were seen by a specialist in neurology, 90% had an electrocardiogram and 93% had the required blood-work performed. 94% of the included patients had magnetic resonance imaging of the cerebrum performed.

CONCLUSION: The diagnostic process which was accelerated in the study-period and the total work-up time were generally low throughout. Key work-up items are currently being completed timely. Further improvements are possible. The enrollment rate has fallen to what we expect will be a steady level.

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TRIAL REGISTRATION: not relevant.

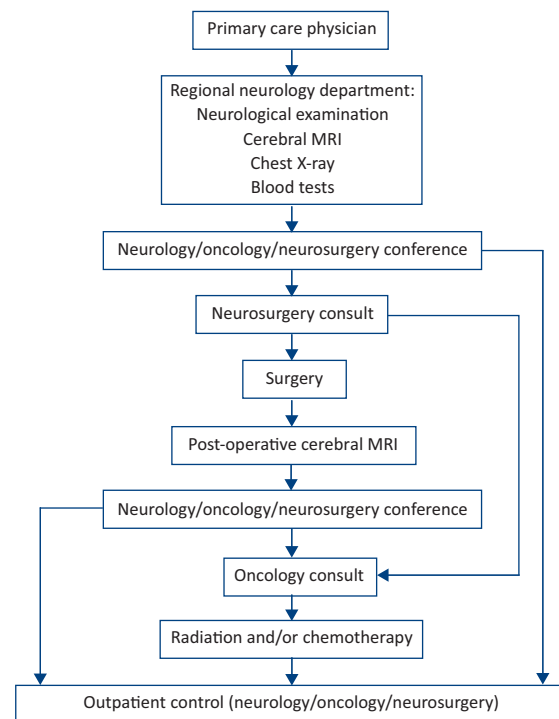
The Danish integrated brain cancer pathway (in Danish: Pakkeforløb for kræft i hjernen (IBCP)) seeks to improve brain cancer survival through early help-seeking and more standardized and expedient diagnostics facilitating faster treatment [1-4]. The background for the nationwide implementation of standardized fast-track pathways has previously been described [5].

The IBCP is a multi-disciplinary effort involving primary care physicians and clinical hospital departments specializing in neurology, neurosurgery, oncology and radiology (Figure 1).

Based on population statistics for the geographical area serviced, approximately 50 patients with primary

FIGURE 1

Flow chart of the integrated brain cancer pathway [4].



MRI = magnetic resonance imaging

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brain tumours are expected to be diagnosed de novo p.a. in our department [6]. Although brain cancer survival in Denmark has improved over the past decade, the prognosis remains grim in most cases both with regard to post-treatment quality of life (QoL) and overall survival. This is due primarily to the aggressiveness of many brain tumours, but also to the problem of latency in diagnostic work-up. A smooth diagnostic pathway combined with all-round care, both during the in-hospital and out-patient course of illness, and aimed specifically at the brain cancer patient is expected to have a positive effect on treatment duration in general and QoL in particular.

Patients in Denmark suspected of having a brain tumour are traditionally referred from primary care physicians to regional neurology departments for diagnostic work-up. Additional referrals derive from other hospital departments, specialist practitioners, or emergency

care. Patients are not referred to a neuro-surgery unit until a diagnosis requiring surgical evaluation has been established.

The initial IBCP work-up in the neurology department encompasses neurologic specialist examination, magnetic resonance imaging (MRI) of the cerebrum, electrocardiography (ECG), chest X-ray and blood tests, information to the patient and relatives followed by obtainment of informed consent and referral for neuro-surgery evaluation as relevant.

The local in-hospital environment for treatment and rehabilitation was already specialized before the implementation of the IBCP but further optimization of the illness trajectory through changes in the organization of the patient flow and in the diagnostic work-up and follow-up processes were possible. Thus, brain cancer has enjoyed a high priority on the local hospital agenda in recent history as a multidisciplinary pathway plan has been created for this disease entity. The brain cancer plan was created at a department level and it details the optimal mono- and cross-disciplinary courses of action in all phases of the illness trajectory, from referral to palliation. As a natural consequence of this project, a local multidisciplinary neuro-oncology team was established that involved specialist physicians, nurses, neuropsychologists, dieticians, social workers and physical, occupational and speech therapists. This team structure ensures the ongoing optimal care and treatment in the very early phases and in the rehabilitation and palliative phases of the brain cancer journey. The importance of a multidisciplinary team structure for complete management of the patient suffering a malignant brain tumour is significant and has previously been described [7, 8].

This paper focuses on the referral pattern and on the time frame of the different initial pathway elements in the initial two-year period following the implementation of the IBCP.

MATERIAL AND METHODS

All patients admitted to the department and enrolled in the IBCP during the two-year period from its implementation were included in the study. Data were obtained from a structured form filled out for each patient during admission by the involved healthcare personnel. This was supplemented by retrospective review of patient charts and radiology reports. Data were entered in anonymized form and processed in an SPSS-based database.

For all patients included in the IBCP, the times from admission to the completion of the following key elements of the work-up were used: MRI execution, chest X-ray, ECG and blood tests. A final radiologic diagnosis was noted for all patients. For patients with intracranial malignancy verified by computed tomography (CT) or MRI, the time of referral to neurosurgical evaluation was noted. The time from admission to initial assessment by occupational and physical therapists was also noted as this has been a prioritized area in the department.

In the patient group with primary intracranial tumour, the point of referral to neurosurgery evaluation constitutes the end of the initial part of the IBCP work-up in the neurology department. For all other patients, i.e. those without primary brain neoplasm, informing the patient hereof constitutes the IBCP exit point.

Time intervals in the diagnostic pathway were calculated as their mean duration in calendar days, thus including weekends and holidays.

Trial registration: not relevant.

RESULTS

During the two-year period from 1 April 2009 to 31 March 2011, a total of 241 patients (132 first year, 109 second year) were enrolled to the IBCP at our department. The number of patients enrolled to the IBCP over the eight quarters shows a decrease of about 25% (Figure 2). However, it should be noted that the patient-base was reduced by approx. 8% from some 350,000 to 322,000 individuals in the first quarter of 2011 due to the process of regionalization.

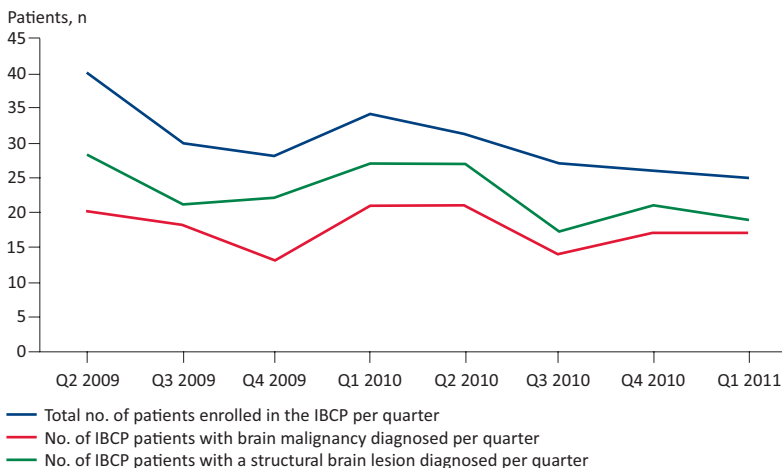
Referral manner

Data on referral manner was obtained in 229/241 cases. Primary care physicians account for nearly half of the referrals in this patient population (45%, n = 102).

A total of 49% (n = 112) were referred directly to the neurology department for suspected brain tumour. Among these, 53 were referred from general primary

FIGURE 2

Number of patients enrolled in the integrated brain cancer pathway (IBCP) over eight quarters after implementation grouped according to diagnosis.



care physicians, 45 from other hospital departments and seven from private neurologist practices.

In all, 37% (n = 85) were initially referred to the neurology department on suspicion of other neurological illness, chiefly from either primary care physicians (n = 48) or from other hospital departments (n = 19). Suspected stroke was the most common referral diagnosis in this group. Clinical neurologist evaluation subsequently revealed that the patients fulfilled the clinical inclusion criteria which led to IBCP inclusion. Emergency admissions without preceding physician contact accounted for 12% (n = 28).

Two patients were first admitted based on progression of other known neurologic illness and then subsequently enrolled to the IBCP.

Time frame of pathway elements

All patients were examined by a physician within few hours of admission and again by a neurology specialist within 24 hours. Initial assessment by a physical therapist was carried out in 92% (n = 221) of cases. 78% (n = 172) of these were seen within 24 hours and 98% (n = 216) within five days of admission. Occupational therapist numbers were very similar with 221 cases evaluated in total, 77% (n = 170) of these within 24 hours and 98% (n = 216) within five days of admission.

Chest X-ray, ECG and a specific series of blood tests are parts of the initial IBCP neurologic assessment, partly for differential diagnostics purposes (Figure 1). Chest X-ray was performed in 226 patients (97% within five days, 74% within 24 hours), ECG in 217 patients (95% within five days, 90% within 24 hours). 99% (n = 239) had the required blood tests taken, 93% of these within 24 hours and 98% within five days of enrollment to the IBCP.

The majority of patients (91%) were assigned a contact physician within 48 hours of admission.

Nearly all patients (94%, n = 226) had an MRI of the cerebrum performed, and 45% of patients (n = 108) were examined with CT scans of the cerebrum (CTC) and MRI both.

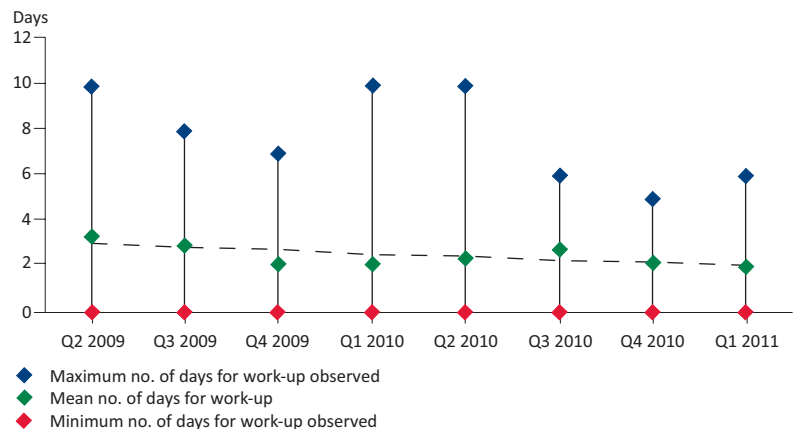
The mean time from patient admission to end of initial diagnostic work-up changed significantly in the two-year study period from a mean time of approx. three days to two days thus showing an overall decrease of 33% in initial diagnostic work-up time (Figure 3).

DISCUSSION

A qualitative UK study by Davies and Clarke [9] revealed that the symptoms recorded in medical records of brain tumour patients often differ from those described by patients and relatives during more in-depth personal interviews. That more than a third of the patients in our study ultimately diagnosed with a brain

FIGURE 3

Number of days spent on total neurology work-up over the first eight quarters after integrated brain cancer pathway implementation.



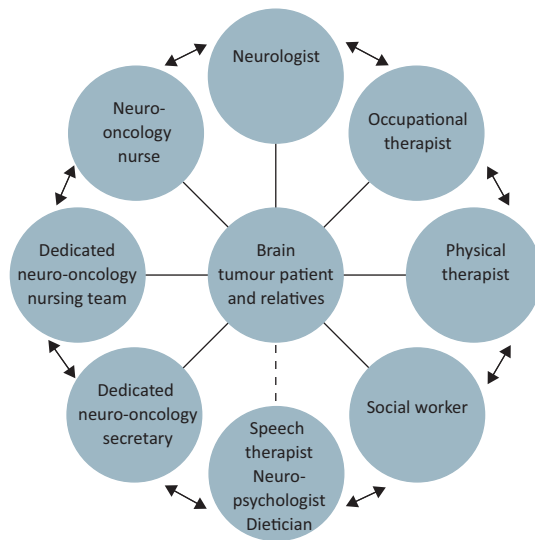
tumour were referred on suspicion of other neurological illness supports the idea that a more thorough investigation in general practice into the anamnesis and quality of symptoms could result in a more focused referral diagnosis from primary care and thus a reduction in referral delay. It is an IBCP requirement that the referring physician informs the patient of the suspicion of brain malignancy. The psychological stress inflicted upon patients by informing them that they may have a debilitating and in most cases ultimately fatal illness is not to be underestimated.

The fact that a third of the patients were referred for neurology consult with a brain scan indicating a tumour could invite the assumption that the clinical inclusion criteria are not sufficiently comprehensive. As described above, most of these patients did, in fact, meet the clinical inclusion criteria also.

It was expected that the majority of patients following the IBCP had been referred from primary care physicians; however, it was surprising that so many were referred due to suspected other neurological illness although they did, in fact, meet the inclusion criteria. This may reflect that knowledge of the IBCP inclusion criteria is still not sufficiently disseminated among general practitioners. Alternatively, it may reflect a reservation on behalf of the referring physician to inform the patient of his or her strong clinical suspicion of brain malignancy.

We expect the number of patients referred with a brain scan showing tumour to decrease over time as the IBCP becomes more widely known and well incorporated into the daily routines of general practitioners. Also, the number of patients meeting the clinical inclusion criteria, but referred under another diagnosis, may decline.

Interdisciplinary team structure.



The diagnostic process has accelerated since the initial implementation of the IBCP. The period from when a brain tumour is first suspected until a radiologic diagnosis is established has been reduced.

MRI of the cerebrum is considered the imaging modality of choice in patients where a brain tumour is suspected. The MRI capacity in Danish Hospitals is increasing but scanning capacity remains limited in most radiology departments. CTC, however, is readily available around the clock in nearly all hospitals. Using intravenous contrast CT scans is an alternative, but less desired radiologic modality in initial brain cancer diagnostics due to its lack of detail and radiation hygiene issues. In the IBCP, MRI is therefore listed as the recommended initial imaging procedure. A great number of patients still undergo a preliminary CT scan before MRI. The goal of being able to offer all patients suspected of brain malignancy an MRI scan of the cerebrum within 24-48 hours of initial physician contact may be a future focus point. Preliminary CT scans are, indeed, valuable in cases where MRI cannot be performed within 48 hours, but do not obviate the use of subsequent MRI to establish a specific diagnosis. CTC continues to be a natural first choice in cases where a differential diagnosis requiring emergency treatment must be ruled out, e.g. sinus thrombosis, subdural haematoma and in all cases where MRI is contraindicated.

Among the other elements of the IBCP, ECG, chest X-ray and blood-work was mostly found to be routinely performed within 24 hours, which was to be expected as these are routine tests that do not require highly specialized personnel.

Evaluation by a physical and occupational therapists is not a required component of the IBCP. Intra-departmentally we do, however, find that this is crucial to determine the optimal illness trajectory – a point that is

emphasized as 75% of patients are assessed within 24 hours and nearly all within five days of admission. The goal continues to be that all patients undergo assessment within 24 hours.

The total time consumption of the neurology work-up of the IBCP decreased over the eight quarters studied with a mean decrease of more than one day corresponding to 33% in the period studied. The emerging tendency is clear and brings time consumption close to the desired goal. Variation in total work-up time is mainly due to reduced delays and optimized access to MRI of the cerebrum.

The number of patients enrolled per quarter has decreased somewhat over time. This may reflect an increased awareness of the new referral manner according to a heightened information level about the IBCP in the first quarter after its implementation. The referral pattern stabilized over time, but continuous information, especially among general practitioners, may be recommended to ensure continuously reduced referral delay of relevant patients. Thirty patients per quarter does not seem to be an unrealistic number from which to set future capacity requirements for a patient base of 350,000.

CONCLUSION

The IBCP is now fully implemented in all applicable departments in Denmark. At our facility, we have evaluated whether the IBCP lives up to its purpose. The number of patients who do meet the inclusion criteria, but are referred on suspicion of other neurological disorders, is high. As the general practice community becomes more familiar with the IBCP, referrals from primary care are expected to be more focused and the number of patients without brain tumours in the pathway thus minimized. More stringent adherence to the inclusion criteria seems to be an important factor in this process, especially bearing in mind that the number of patients seen in general practice who suffer from primary headache, stroke and seizure disorders with no underlying malignant cause far exceeds the number of those with brain tumours.

At present, there seems to be a need for more in-depth information to primary health care professionals regarding referral to the IBCP.

The results show that the diagnostic process has accelerated since the initial implementation of the IBCP, but that the total work-up time was generally low throughout the period. The key items of the IBCP that are placed under the responsibility of the neurology departments are currently being fulfilled within a satisfactory time frame, but further improvements are possible. Many patients still receive both CTC and MRI of the cerebrum. The number of patients going through

work-up in the IBCP has fallen to what we expect will be a steady level.

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