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A Prospective Survey Evaluating Satisfaction and Perception about CyberKnife Treatment in Indian Patients and Caregivers

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Abstract: ***Aims / Objectives:*** *Evaluation of patient perception and satisfaction regarding CyberKnife (CK) treatment in Indian patient population.* ***Materials & Methods:*** *124 consecutive patients treated with CK and their caregivers had survey questionnaire before and after treatment to evaluate the perception and satisfaction of treatment.IRB approved questionnaire for patient and caregiver in Malayalam/ English were used as assessment tool. Socio-demographic and patient related factors affecting patient satisfaction were evaluated.* ***Result:*** *124 patients prospectively evaluated with questionnaire survey [Mean age 54 years, 52% male, 88% married, 58% patients residence within 100km,63% of patients are non-earning member of the family]. 27% are graduate, 25% homemaker, 51% patient had intracranial tumour, 14% liver tumour and 22% treated had metastasis. 71% of patients treated with radical intent, 29% patients as primary treatment, 38% in recurrent and 33% in metastatic setting. Before CK, 35% responded CK as 'RT treatment'. 23% as 'high dose & short course' RT, 21% as 'alternative' to surgery. 60% responded as 'CK will certainly' control of disease and 4% as 'not sure'.66% choose CK as it is'1 hour long but more accurate' and only 2% suggested that they will opt for short treatment (15 min) with slight compromise in 'quality' of treatment. 60% responded CKas' costly but more effective' and 7% feels it is still investigational. After CK,82% responded treatment as 'comfortable', 73% no or minimal side-effect, 69% 'treatment experience was better than expected'. 'Expectation' regarding treatment was higher in younger patients [<55yrs Vs .55yrs; p-value: 0.064]. Concern for 'side-effect' was higher in poorer educational strata (p-value: 0.053). Professionals (p-value: 0.071) and patients from distant places (>300km(p-value: 0.013) were more optimistic ('certainly effective') regarding the treatment outcome. Radical intent patients were more 'certain' regarding CyberKnife as 'standard' treatment method, compared to palliative patients (p-value: 0.079).* ***Conclusions:*** *Majority understands CK as radiation treatment. CK treatment experience is 'better than expected' in majority of patients. CK is considered 'effective but costly' treatment. Majority have no complains after CK. Various socio-economic factors influence perception regarding CK.*

Keywords: *CyberKnife, Indian patient, Satisfactory, Questionnaire, Cost-effectiveness*

INTRODUCTION

Modern technology is abundantly being used in cancer treatment[1]. Majority of the modern technology do not improve survival, but improves quality of life, patient comfort, shorter treatment duration and shorter hospital stay[1, 2]. Robotic surgery, endoscopic surgery, minimal invasive surgery, radiosurgery are different new treatment modalities which improves patient experience regarding treatment, but there are very less or restricted information for patients regarding these treatment modalities[3,4]. Patients and caregivers have different perception about these treatments. Interestingly, the perception regarding the treatment guides the patient to select the treatment modality[5]. Hence, perception about the treatment modality is critical for the acceptance or failure of treatment modality. Patient satisfaction after treatment is proportional with to the 'expectations' or 'perception'[6]. Perception depends upon the socio-economic status of the patient population, acceptability of the treatment facility in the community and also with cost of treatment vis-a-vis benefits in-terms of survival improvement and 'quantity' of preservation of quality of life parameters[2]. Satisfaction of treatment also depends upon many soft parameters, such as caregivers hospital visit frequency, less duration of hospital waiting, minimal morbidity and less care requirement to the patient after treatment[6]. Perception and satisfaction of treatment modalities may be different in patients and caregivers. Ironically, long duration radiation therapy may be perceived as cost-effective and short course CyberKnife may give more satisfaction. Satisfaction parameters and cost-effectiveness of short course radiation therapy in breast cancer patients in resource constrained/limited Indian subcontinent may be higher compared with western population. Hence, shorter course radiation therapy in breast cancer gets a boost in resource constraint countries, and more patients in the society opt for breast conservation with radiation therapy[7]. Perception and satisfaction parameters after treatment and cost-effectiveness of a treatment modality are different in different socio-economic populations[8]. Hence, there is a need to evaluate the perception regarding a treatment modality and satisfaction after treatment in different socio-cultural patient population. Assessment of patient satisfaction has paramount

importance in maintaining the 'quality' of health care provided to the patients. It helps to identify areas of healthcare that needs further improvement. With the help of such patient satisfaction assessments we can identify whether the service providers meet patient's expectations or not. This is particularly relevant in the field of radiation oncology where the technological advancements are taking place at a rapid pace and the radiation treatment is becoming increasingly complex and expensive with claims of improved treatment quality.

The present study is an institutional ethical and scientific committee approved prospective survey evaluating patient and caregiver's perception before after CyberKnife treatment in Indian patient population.

MATERIALS AND METHODS

All consecutive patients planned for CyberKnife radiosurgery treatment in one calendrer year were accrued in the institutional ethical and scientific committee approved protocol. Patients and caregivers were explained the cyberknife treatment procedure, impact of treatment, benefit in-terms of survival outcome and improvement of symptoms, quality of life (QOL). After consent, patients were assessed with questionnaire evaluation and planned for treatment with CyberKnife as per schedule. Institutional questionnaire for survey was prepared for the study purpose. Different aspects regarding CyberKnife treatment perception were asked in survey questionnaire format before and immediately after the treatment. Survey questionnaire was translated native language from Malayalam as per norms [Supplementary 1 & 2]. Validation of translation was done as per questionnaire translation procedure. Patient related and socio-economic factors influencing the perception regarding CyberKnife were analysed.

In the present study, satisfaction was also evaluated at 6 month and 1 year after treatment completion. Present manuscript focusing on perception regarding CyberKnife in Indian patient population and satisfaction survey will be explained in details in subsequent manuscript.

Data collection and statistical analysis

All the patient data were collected prospectively and analyzed with SPSS version 20. Survey response before and after CyberKnife treatment were documented. Dosimetric and socio-economic parameters were collected. Factors influencing perception parameters were analysed using non-parametric t-test. Changes in perception parameters after treatment were analysed as per variable parameters.

RESULTS

Demographic parameters

Among 124 patients prospectively evaluated with the survey questionnaire, the demographic parameters are described in table 1. Mean age 54 years, 52% male, 88% married, 58% patients residing within 100 KMS, and 63% of patients are the non-earning member of the family. 27% are graduate, 17% post graduate, 15% of patients are retired, 25% home maker, 22% professionals and 10% students. 51% patient had intracranial tumour, 14% liver tumour and 22% treated had metastasis. 71% of patients treated with radical intent, 29% patients treated as primary treatment, 38% in recurrent and 33% in metastatic setting. 40% of the patients had surgery, 10% of patients received chemotherapy and only 3% of patients had radiation therapy prior to CK treatment [Table I].

Questionnaire to patients before CK

Details of response regarding patient questionnaire before CK treatment is descried in table 2. 78% of the patients were referred by physicians, 2.4% through print media and only 7% through internet information sources [Figure 1]. Regarding perception about CyberKnife, majority (35%)understand that it is a radiation therapy treatment. 23% understand that it is 'high dose & short course' radiation therapy and 21% feel it is alternative to surgery. 60% patients responded that CK will 'certainly' control the disease, 23% feel that CK will 'most likely' control the disease, 5% responded that CK will "maybe" control the disease and 4% were not sure of the outcome.

Questionnaire to care-giver before CK

Majority of responders were close relatives (79%) and only 13% were non-close relatives or friends. 18% feels Cyberknife is a surgery tool, 22% as radiation therapy and 33% are aware of CyberKnife as robotic radio surgery system. 54% feels CyberKnife will 'certainly' control the disease, 22% 'most' likely, and 14% are 'not sure'. Benefits of Cyberknife as 'short course' treatment is considered by 62%, 6% feels it will be 'cumbersome' treatment and only 4% feel that though treatment is short one needs to be in hospital for long hours. 66% feels that after treatment patient will be fine without help, 14% feels that there may require observation for few hours and only 4% feel that hospitalization may be required after treatment. 66% suggested that they will choose treatment if it is '1 hour long but more accurate' and only 2% suggested that they will opt for short treatment (15 min) with slight compromise in 'quality' of treatment. 60% of care-givers think that Cyberknife though costly is more effective and 7% feel it is still investigational [Figure 2].

Questionnaire to patient after CK

After treatment, 77% of patients feel that disease will be controlled, 60% responded that the treatment was painless without any difficulty, 82% feels that the treatment was 'comfortable', 73% responded to have no or minimal side-effect, 69% responded the treatment experience was better than expected [Figure 3].

Questionnaire to care-giver after CK

73% of care-givers responded that the treatment experience met the expectations, 13% felt that though treatment met the expectations there was some logistic difficulty for treatment, only 1patient was 'disappointed' with the treatment and which could be due to 'machine downtime' related long waiting for treatment [Figure 4].

Comparison of response between patient and care-giver

Comparison is described in table 6. Perception regarding cyberknife as radiation therapy tool, effectiveness, indication for treatment and cost effectiveness was similar in both patient and care-giver [Figure 5]. After treatment, 'met expectation' parameter was similar in both patients and care-giver (75% Vs 73%). However, patients felt that 'treatment was more comfortable' than expectation in 69% compared to 6% among care-givers. On the other hand, majority (65%) of care-givers responded that treatment was 'similar to that expected' [Figure 6].

Factors influencing the satisfactory survey scores

Different patient related and socio-economic factors were analysed that may influence scores [table 2]. 'Expectation' regarding treatment was higher in younger patients [<55yrs Vs .55yrs; p-value: 0.064]. Assumption regarding 'side-effect' was higher in poorer educational strata (p-value: 0.053). Professionals were more optimistic ('certainly effective') regarding the treatment (p-value: 0.071). Patients from distant places (>300KM) were also more optmistic regarding the treatment outcome (p-value: 0.013). Patients planned for radical intent were more 'certain' regarding CyberKnife as 'standard' treatment method, compared to patients treated with palliative intent (p-value: 0.079).

DISCUSSION

Radiation therapy is one of the standard treatment option in a majority of cancer patients. Conventional treatment is of long duration, usually 5 to 6 weeks course daily treatment. Long duration of treatment and acute toxicities related to the treatment are major concern for the patients. Short course radiation therapy is suitable for the patients, but high precision radiation therapy with shorter course such as CyberKnife also have its own concerns[9]. Long-term effect of shorter course RT is still under evaluation. High precision shorter course RT with radio surgery tools like CyberKnife need evaluation for cost-effectiveness in Indian subcontinent. There is also a need to assess the impact of short course RT in patients and care givers. Long course RT requires few weeks 'daily attendance' of patient and care givers which have implications on leaves and result in salary loss. Short course RT with radiosurgery tool like CyberKnife may be more expensive as treatment, but as the treatment duration is short, ultimately patient may need to spend less for treatment. Perception regarding treatment depends upon various socioeconomic factors, and need to be addressed among patients and caregivers[6].

The 'radiosurgery' or 'CyberKnife' as a treatment is new and not yet an 'established' treatment modality in Indian subcontinent. There is a general fear about the word 'Knife' and 'side-effects' of treatment. There is also lack of information that 'CyberKnife' or 'radiosurgery' is only a precise radiation therapy treatment delivery technology. There are many issues related to awareness such as utility, indications and modality of treatment that need more awareness. Perception and information received through unreliable internet sources may also confuse patients about the utility of any new technology[11].

The present prospective study evaluating the 'perception' regarding 'CyberKnife' treatment before and after treatment in both patient and caregiver. Majority of the patients and caregivers do understand that radiosurgery is a radiation therapy technology. Most are highly optimistic regarding the treatment outcome after treatment. Patients perception before treatment about radiosurgery is 'no pain, no difficulty'. Majority of patients and caregivers believe 'CyberKnife' is a 'standard' treatment option for their disease. There was no difference in perception regarding CyberKnife before treatment in both patient and caregivers. After treatment, 70% of patients and felt that the treatment experience was 'better than expected', whereas 65% of caregiver feels treatment is 'similar to that expected'. Only 2% responded that the experience is 'less comfortable than portrayed'.72% patients was fine after treatment and went back home without any assistance. 15% of the patients required medications in the form of steroids to reduce oedema. Only one patient had to be kept under observation for more than 2 hours for medical assistance. He was hydrated and given supportive care. After treatment, most of the patients and care givers feels that CyberKnife is costly but effective treatment. Only 6% feels that treatment is very costly and not cost-effective'.

Toxicity after treatment and efficacy of treatment depends upon case selection. Appropriate case selection will reduce toxicity and improve efficacy. Patient perception and acceptance of treatment also depends upon case selection. In our patients 70% of the treatment was radical intent and only 30% were palliative (oligo metastasis). Cost-effectiveness of treatment depends on the 'cost of treatment' and 'benefit' in-terms of symptomatic relief or survival benefit patients receives from the treatment. Our institute is an academic institute with social support for patients and hence CyberKnife treatment may be cost effective even in palliative indications. However, perception about treatment depends upon awareness. Socio-economic factors play an important role in perception about treatment modality. Professionals are more optimistic about Cyberknife treatment outcome.

Patients travelled from far places for treatment are more optimistic about treatment outcome. Patients with brain lesions feel CyberKnife is 'surgery without knife'. Younger patients feel that CyberKnife treatment have 'met their expectations'. Less educated and economically challenged patients are more worried about the treatment side-effects. Patient perception is varied among socio-economic strata. Knowledge about the treatment and disease, social security in the form of economic stability and intent (curative) of treatment influence the perception about radiosurgery and also acceptance of the treatment.

Perception about treatment modality and satisfaction with treatment is important in situations where there are many treatment options with similar outcome and different toxicity profiles. In acoustic schwannoma, microsurgery and radiosurgery has similar outcome, 95% control at 10 years. Microsurgery have higher risk of hearing function loss and facial palsy. Whereas with radiosurgery, response may take 1-2 years and may cause 'pseudo-progression' leading to headache[12-14]. Perception about the toxicity profile, acceptance of the outcome and satisfaction with treatment modality will help in selecting optimal treatment modality. Perception and satisfaction with treatment modality have been studied extensively in acoustic schwannoma and meningioma [15]. Microsurgery and radiosurgery has similar acceptance as modality and hence, both are considered as treatment option. Similarly perception and satisfaction in trigeminal neuralgia patients treated with microvascular decompression (MVD) or radiosurgery were extensively evaluated. Both had different toxicity profiles, but MVD had long lasting pain control with better acceptance and hence considered as the first option[16-17]. Perception and satisfaction has significant implications in many clinical situations. It seems, that 'clinically sick patients' are always less 'satisfied' with out-patient treatment[18]. Longer waiting time and comfortability issues during waiting may be the possible reason. Elderly patients are also less 'satisfied' with any treatment modality[19]. There are various factors mentioned that influence 'satisfaction' of in-patients, such as nursing attendance, cleanliness and number of visits by consultants[20-21]. Actual treatment sometimes takes a backseat in perception and satisfaction about many treatment modalities. Minimal invasive surgery such as endoscopic surgery, different surgical approaches including VATS, robotic surgery, laparoscopic surgeries have almost similar outcome with differential toxicity profile[22]. Patient perception about the treatment and satisfaction determines the treatment modality used in different situations. Even the radiation therapy schedule may be determined by the patient perception. In advanced lung cancer or in prostate cancer there are different radiation therapy treatment regimens and patient perception do help in selecting the optimal schedule[23].

There is a '5 test' hypothesis about social psychological determinants in treatment perception (6). Various patient characteristics, such as education status, socio-economic status, travel distance for treatment and social support determine treatment satisfaction. There are different satisfactory survey questionnaires, such as PAT-SAT32, FACT and many site specific questionnaires[1, 6]. They are validated and commonly used to evaluate the satisfaction of any new treatment modality. Institution specific surveys are also used in many situations. The larger question is 'whose perception' is important in medical management. Patient perception may be flawed as it is dependent on information and counselling. Caregiver perception may be influenced by cost of treatment. And clinicians perception depends upon expertise of that particular clinician. This leads to bias and limits the value of perception. Many a times, robotic surgeons have perception that surgery is better option than radiosurgery in low risk prostate cancer. Patients are not even offered radiosurgery as an option. Robotic surgery and radiosurgery have similar outcome with different toxicity profile. It is the patient that should determine the possible treatment related toxicity that is more convenient to him. Unfortunately, in Indian subcontinent these options are most of the time not given to the patients. Many times, patients choice and perception are not taken into consideration. Hence, there is bias in treatment modality selection too. Similar situation exists in neurosurgery as well. Hence, perception of clinicians and their expertise influence heavily the treatment modality. Patients perception in selection of treatment modality is paramount where outcome is similar and toxicity profiles are different. Acceptance of toxicity may be different in patients; it is the toxicity that determines the choice of treatment modality[5, 8-9].

Perception study also can help in evaluating the 'quality' of hospital services. Good service do influence perception about the treatment modality. Perception among common people can be addressed using social media[11]. Promotion and active presence in social media influence the perception about treatment modality. Perception is an important issue in western practice, unfortunately in Indian subcontinent patient perception and choice is ignored.

Our study is one of the very few studies from Indian subcontinent evaluating the patient perception regarding a treatment modality before and after the treatment. This prospective study is unique in the sense that perception of patient and caregivers were evaluated in all consecutive patients treated with cyberknife in a specific time duration. Concurrence about perception in patients and caregivers were evaluated. Factors influencing the perception were also considered. The present manuscript is a part of a prospective study evaluating the perception about CyberKnife before and immediately after the treatment. Long-term cost effectiveness and satisfaction study in

the similar patient cohort is being evaluated as a part of this ongoing prospective study. The survey questionnaire was an institutional ethical and scientific committee approved protocol. There was no validation of the questionnaire. The protocol was planned as a 'survey' and hence, validation process was omitted. Socioeconomic status of the present institute may influence the questionnaire response. Multi-centric study may provide appropriate information regarding the perception in Indian patient population.

In Summary, in majority of the patients and caregivers Cyberknife radiosurgery treatment have 'met their expectations'. Radiosurgery is considered 'costly but effective' treatment. Majority of the patients had no complain after treatment and went home within hours of treatment. 'Expectation' regarding treatment was higher in younger patients, assumption regarding 'side-effect' was higher in poorer educational strata and professionals were more optimistic ('certainly effective') regarding the treatment outcome. Patients planned for radical intent were more 'certain' regarding CyberKnife as 'standard' treatment method. Short course radiation therapy with CyberKnife is more acceptable option in benign and curative indications. CyberKnife in metastatic setting need to be addressed with maturity and need involvement of caregivers.

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Legends:

Table 1: *Demographic profile of consecutive patients treated with CyberKnife radiosurgery (n=124)*

Age	Mean	54yrs
	<55 yrs	59 (48)
	>55 yrs	60 (52)
Gender	Male	64 (52)
	Female	60 (48)
Residence	State	112 (90)
	other part of country	8 (6)
	International	4 (4)
Education	<5th Std	23 (18)
	Undergraduate	38 (31)
	Graduate	33 (27)
	Post-graduate	21 (17)
Profession	Retired	19 (15)
	Homemaker	31 (25)
	Business	10 (8)
	Office worker	27 (22)
	Student	12 (10)
	Small worker	10 (8)
Marital status	Married	109 (88)
	Unmarried	10 (8)
Earning status	Earning member	40 (32)
	Non-earning member	78 (63)
Distance	<100KM	58 (46)
	100-300KM	37 (30)
	>300KM	29 (23)
Income	<1 lakh INR/ yr	4 (3)
	1-5 Lakh INR/ yr	22 (18)
	5-10 lakh INR/ yr	2 (2)
	>10 lakh INR / yr	5 (4)
Dependent	None	52 (42)
	One	18 (15)
	Two	16 (13)
	more than 2	22 (18)
Site	Brain	63 (51)
	Liver	18 (14)
	Metastasis	28 (22)
Intent of Rx	Palliative	31 (25)
	Radical	88 (71)
Diagnosis	Benign brain tumour	61 (49)
	HCC	18 (15)
	Brain mets	21 (17)
	Oligo-mets	9 (8)
Rx type	Primary	36 (29)
	Recurrent	47 (38)

	Metastasis	41 (33)
Previous Rx	Surgery	50 (40)
	Chemotherapy	13 (10)
	Radiation Therapy	4 (3)

Table 2: *Patient related and socio-economic factors influencing perception regarding Cyberknife treatment in Indian patient population*

	Age	**Education**	**Profession**	**Earning status**	**Distance**	**Site**	**Rx intent**	**Diagnosis**
	<55yr Vs<55yr	Under grad Vs Post Grad	Home maker Vs Professional	Earning Vs Not Earning	**<100KM Vs>300KM**	**Cranial Vs Extra**	**Radical Vs Pall**	**Benign Vs Mets**
	p-value	**p-value**	**p-value**	**p-value**	**p-value**	**p-value**	**p-value**	**p-value**
CyberKnife perception								
1) Surgery tool without knife 2) Radiation machine - High dose & short course 3) Alternative to surgery 4) Robotic surgery with Radiation	0.676	0.358	0.879	0.366	0.836	0.075	0.386	0.105
Efficacy of CyberKnife								
1) Certainly 2) Most likely 3) May be 4) I am not sure	0.135	0.556	0.071	0.421	0.013	0.441	0.198	0.907
As Standard Treatment option								
1) Standard in my case 2) Recommended treatment 3) Surgery is standard, Chose surgery as painless 4) CyberKnife is investigational	0.535	0.259	0.326	0.896	0.348	0.387	0.079	0.718
Expectations								
1) Met my expectation 2) Met to some extent 3) Somewhat disappointed 4) Very disappointed	0.064	0.675	0.53	0.849	0.684	0.718	0.102	0.567
Side-effect								
Minimal side-effect some side-effect Required medication Significant side-effect	0.731	0.053	0.332	0.945	0.838	0.417	0.278	0.944

Figures:

Figure 1:*Questionnaire to patients before CK*

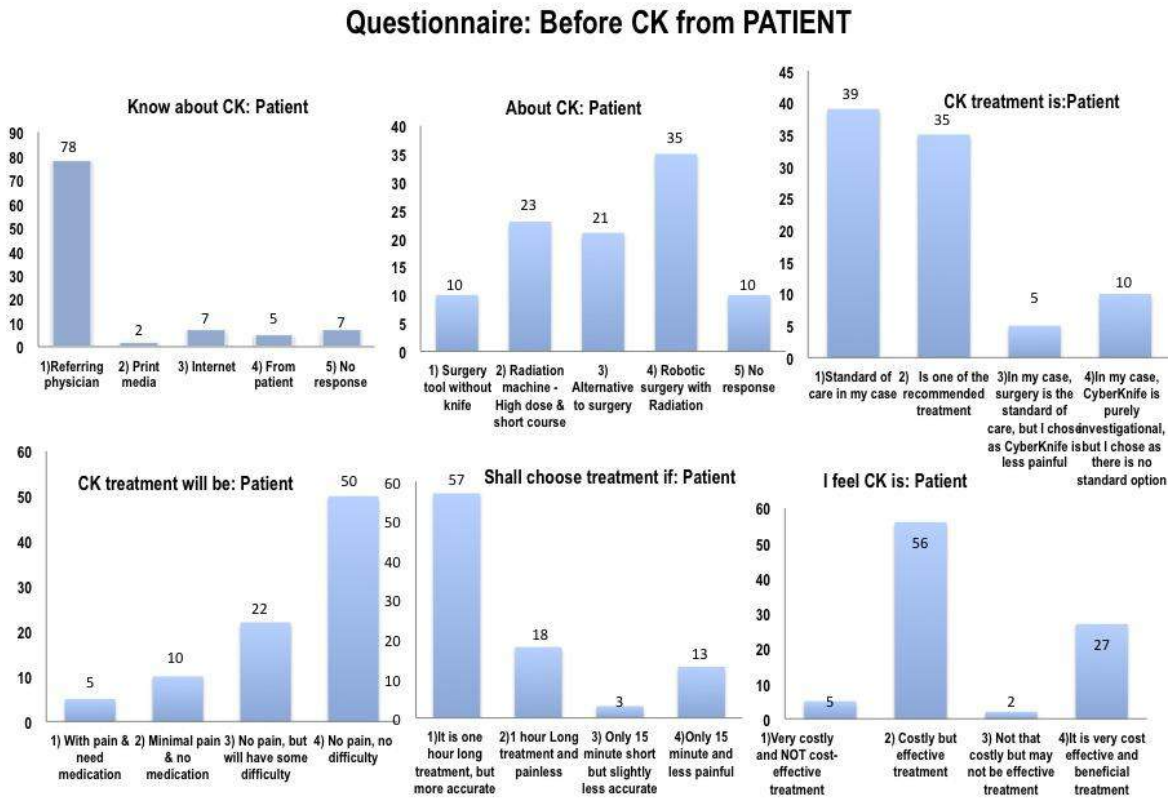

Figure 2:*Questionnaire to care-giver before CK*

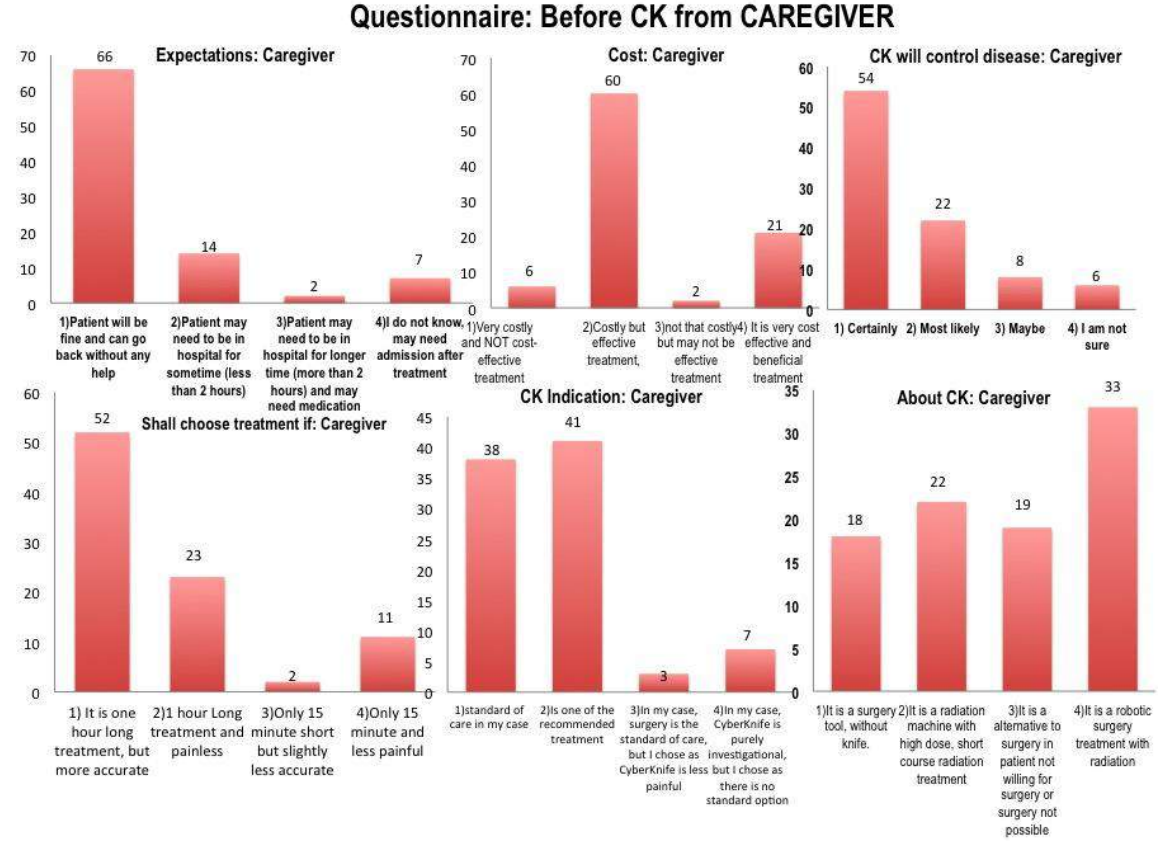

Figure 3:*Questionnaire to patient after CK*

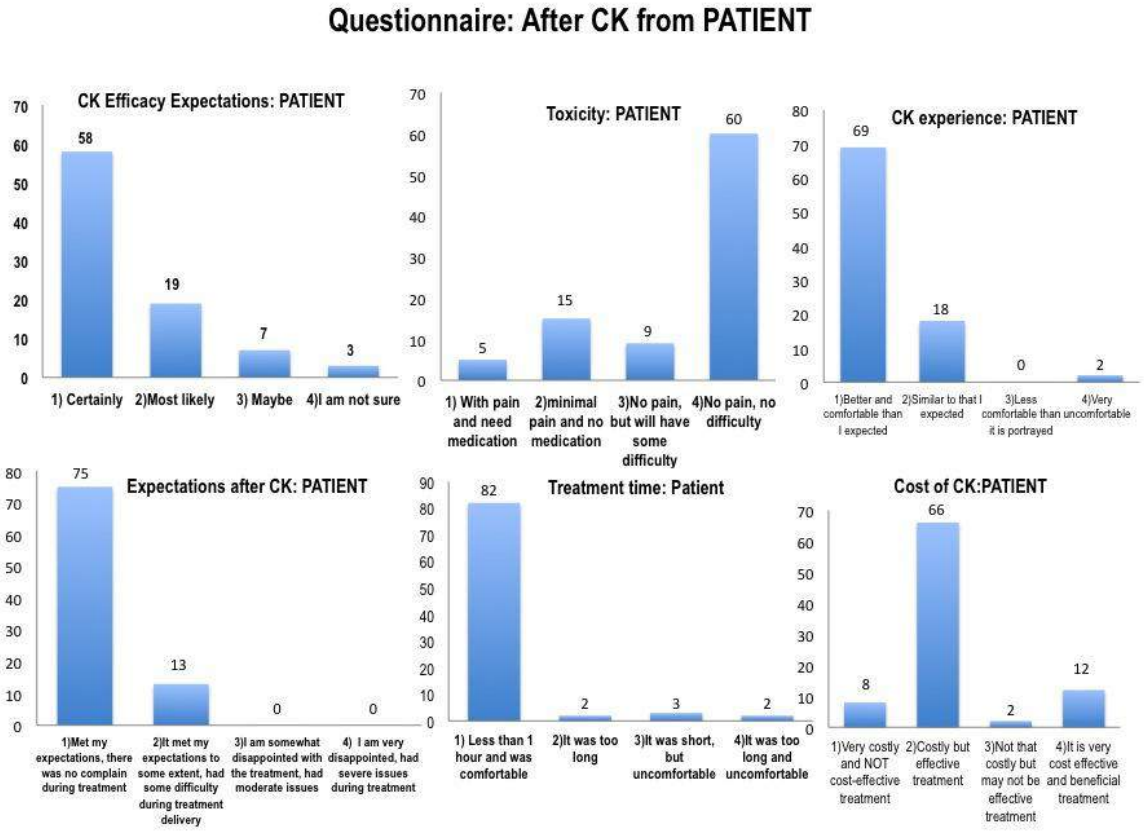

Figure 4:*Questionnaire to care-giver after CK*

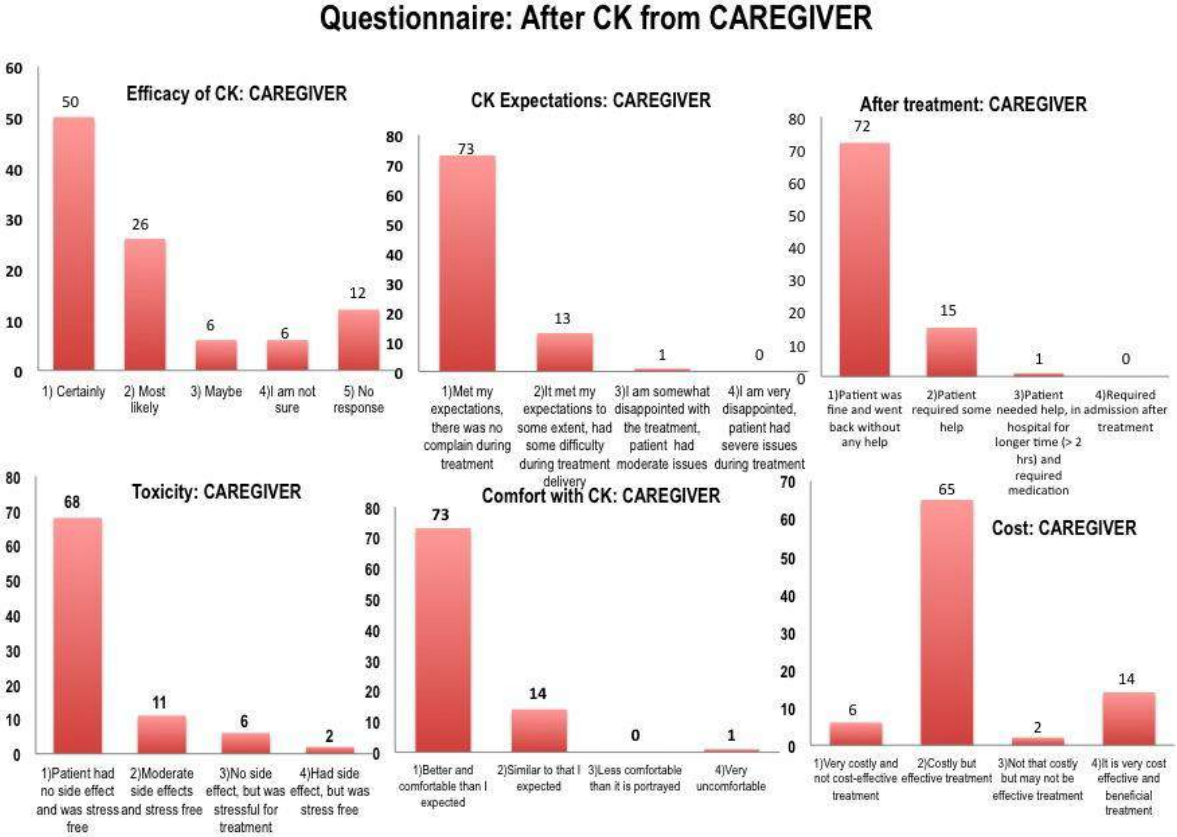

Figure 5:*Comparison of response between patient and care-giver- 1*

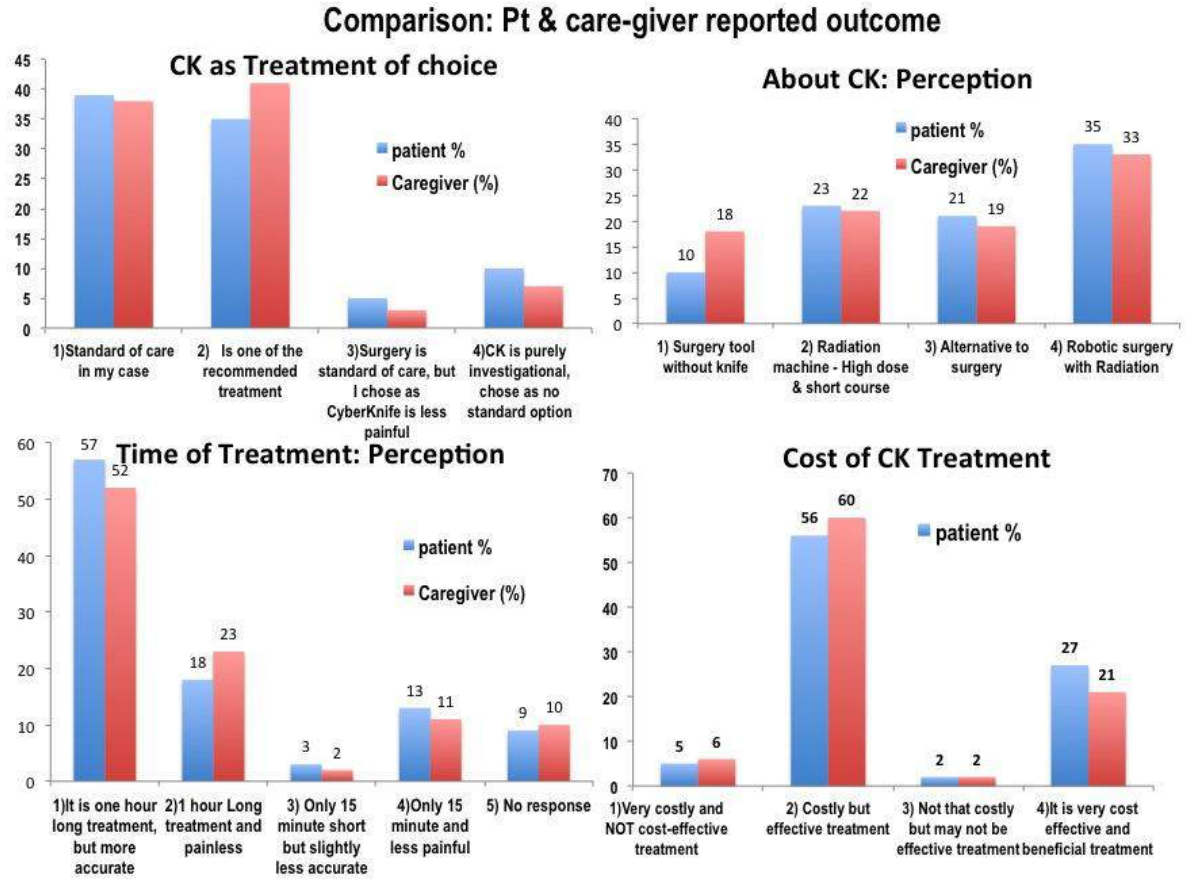

Figure 6:*Comparison of response between patient and care-giver- 2*