ORIGINAL ARTICLE

Effectiveness of Ambulation on Self-Care Abilities among Patients Extubated from the Ventilator

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Abstract

Background: Intensive care unit (ICU) is a major component of health care environment in a hospital where ventilation support plays a crucial role, and this makes the patients to be restricted to bed and may face difficulties in their self care abilities after extubation. The present study aimed to assess the effectiveness of ambulation on the level of self-care abilities of patients weaned from the ventilator in the intensive care unit.

Objective: The objectives of the study were to assess the level of self-care abilities, to determine the effectiveness of ambulation, and the association with clinical variables among patients weaned from the ventilator in the interventional and non-interventional groups.

Methodology: A quasi-experimental time-series design was adopted for this study. The study was conducted with a sample size of 30. The interventional group patients (n=15) received ambulation after weaning and the control group patients (n=15) received routine ICU care. The distance and period of ambulation were progressively increased for the next five days from the initial visit. Data were collected about their activities of daily living for up to five days.

Results: In the pretest, all the 15 (100%) patients were in a dependent state. On the fifth day of observation, 14 (93.3%) patients were independent and only one (6.7%) was partially dependent in the interventional group. Out of 15 patients in the non-interventional group, only nine (60%) were partially dependent, and six (40%) were independent on the fifth day of observation. There was a statistical significant improvement (p <0.001) in the level of self-care abilities within the interventional group, between the pretest and post-test values taken on the second, third, fourth, and fifth day of observation. Practicing ambulation after weaning from the ventilator was found to be effective. There was a significant improvement in the level of self-care abilities between the interventional and non-interventional groups on the second, third and fourth day of observation (p <0.05).

Conclusion: The findings of the present study suggests that all intensive care nurses can practice ambulation for the patients soon after they are weaned from the ventilator to regain their self-care abilities as early as possible.

Keywords: Ambulation, Intensive care unit, Rehabilitation, Critical care, Patient with ventilator, Weaning from ventilator, Self care abilities, Effects of immobilization, Barthel index, Activities of daily living

Introduction

Intensive care units are designed to meet the special needs of acutely and critically ill patients as they being physiologically unstable, require advanced and sophisticated judgments by the nurses and physician.

The nurses in the intensive care units care for patients and their families admitted with acute and unstable physiologic problems by being equipped with technologically advanced methods of assessing and managing patients with problems.

The patient in the ICU often requires mechanical assistance to maintain a patent airway. The patients in the intensive care unit supported by mechanical ventilators are immobilized and are at risk of developing complications like substantial functional disabilities, and difficulties in meeting their activities of daily living (ADL). These disabilities are more severe in patients on ventilation for a longer period.[1]

Weaning from the ventilator involves a change in the interaction between the patient and the ventilator. The purpose of the weaning process is to decrease the level of support provided by the ventilator, requiring the patient to assume a greater proposition of ventilator workload. Thus the work of breathing is shifted from the ventilator to the patient.

Ventilation support is frequently provided to critically ill patients due to respiratory failure precipitated by an underlying disease, adverse effects of medication, and periods of prolonged immobilization. Patients requiring prolonged mechanical ventilation often have substantial muscle wasting.[2]

The long-term use of mechanical ventilators may be a risk factor and a cause for ICU-acquired weakness, which has been observed in one-fourth of patients requiring >7 days of mechanical ventilation. Excessive immobilization is a major cause of ICU-acquired weakness[3] and a relationship between muscle weakness and duration of immobilization has been observed in patients with acute lung injury, whose muscle strength at the time of hospital discharge and two years later was reduced by 3 and 11%, respectively, per each day of immobilization.[4] Therefore, patients mechanically ventilated in the ICU are likely to benefit from early mobilization to prevent ICU-acquired weakness, maintain long-term function, and preserve Quality of Life (QOL).

While early mobilization has become easier to implement, few randomized trials have examined its effectiveness in mechanically ventilated patients. In a landmark study, Schweickert et al. randomly assigned 104 mechanically ventilated patients to early physical and occupational therapy versus usual care and compared the proportions of patients in each group who returned to independent functional status at the time of discharge from the hospital. An independent functional status at hospital discharge was regained by 59% of patients in the intervention group, in whom early mobilization began at a mean of 1.5 days after the onset of mechanical ventilation, compared with 35% of patients in the control group in whom early mobilization began at a mean of 7.4 days

($p = 0.02$). Patients in the early mobilization group also suffered from shorter periods of delirium and required fewer days of recurrent mechanical ventilation than the control group during 28 days of follow-up.[5] Burtin et al. evenly assigned 90 mechanically ventilated patients to (a) a 20-min session of bicycle ergometer exercise daily, 5 days/week, in addition to standard care, versus (b) standard care only, and compared the outcomes of 6-min walk tests at the time of discharge from the hospital.[6] In the intervention group, the median 196 m covered in 6 min was significantly longer than the median 143 m covered in the control group. Furthermore, physical function ascertained by the 36-item Short-Form Health Survey was significantly greater in the intervention than in the control group, and the quadriceps femoris strength at discharge was significantly increased in the intervention group, but not in the control group.[6]

World Health Organization defined health as a state of complete physical, mental, social, and spiritual well-being and not merely the absence of disease or infirmity. To attain the above set goal, ICU nurses are principally responsible for rehabilitating the given patient.

The primary goal of the rehabilitation is to restore the patient's higher level of independent function which is accomplished by helping patients to become more actively involved in their health care, more independent in performing daily activities, and less dependent on others, including health professionals. A physical therapy program initiated in the ICU with focused early mobilization and ambulation can improve the functional ability.[7]

Formal exercise training benefits the patient with perceived exercise capacity. Simple exercise may be more realistic for sedentary patients and it will improve their endurance fitness and high-density protein profile by engaging in regular brisk walking. Benefits of ambulation include strengthening the muscles, especially those of the abdomen and legs, helping joint flexibility of the hips, knees, and ankles, stimulate circulation, which helps to prevent phlebitis and the development of stroke-causing clots. Ambulation also prevents constipation because the movement of the abdominal muscles stimulates the intestinal tract. It also helps to prevent osteoporosis which occurs due to mineral loss from the bones. In addition, it stimulates the appetite and helps to prevent urinary incontinence and infection thereby enabling the patients to go to the bathroom on their own. It relieves pressure on the body and skin thereby preventing pressure ulcers. This indirectly

improves self-esteem, and the ability to socialize and build the resident's feelings of independence.[8]

In response to the ever-changing delivery system in health care, intensive care nurses are championing the needs of the patient and the family or significant others. So it has been decided to practice ambulation for patients after they were weaned from the ventilator.

Materials and Methods

The quasi-experimental time-series research design was used for this study. The study sample included 30 male and female patients who have been weaned from the ventilator (interventional group-15 and non-interventional group-15) and the subjects were selected by non-probability convenient sampling technique from C4 multidisciplinary intensive care unit of Sri Ramachandra Medical Centre, Porur, Chennai. Ethical clearance was obtained from the institution. Patients were selected according to the inclusion criteria, and informed consent was obtained from the selected patients. Unit and the patients were prepared. Baseline data were collected from the patient and recorded. Patients with stable hemodynamics were mobilized from bed to chair after weaning from the ventilator. The patients were initially ambulated from bed to chair, and on the second day, within the ICU near the bedside for five meters for about seven minutes. The distance and the period of the walk was progressively increased for the next five days. Data about their self-care abilities for five days or until they resumed activities independently (whichever was earlier) were collected.

The tool used for data collection was an observational checklist with two parts.

Part 1- Consisted of selected demographic variables of patients who were weaned from the ventilator, including age, sex, educational status, occupation, marital status, type of family and clinical variables such as diagnosis, period of ventilation, duration of ICU stay and indication for intubation.

Part 2- Inlcuded observational checklist on activities of daily living of the patients, based on Barthel index scale. The tool used was a checklist of seven items such as feeding, grooming, dressing, bladder control, chair/bed transfer, ambulation, stair climbing, which was modified from Barthel index scale to measure the degree of assistance required by an individual on items of mobility and self care activities of daily living. Each item of the list had two, three and four components appropriately, which scores the patient according to their level of dependency. The total score of the modified Barthel index scale is 75. The patients with a score ranging from 51 to 75 were considered as independent, with a score of 26 to 50 as partially dependant, and with a score of 0 to 25 were considered as totally dependant. Modified Barthel index scale has split haff Guttman reliability (0.6).

Results

The data collected were tabulated, analyzed, and presented in tables.

Table 1: Frequency and percentage distribution of patients according to the demographic and clinical variables (N=30)

	Demographic variables	Interventional group		Non-interventional group	
		(n=15)	%	(n=15)	%
1	**Age in (Years)**				
	a. 25 – 35	1	6.7	2	13.3
	b. 36 – 45	-	-	1	6.7
	c. 46 – 55	3	20	5	33.3
	d. 56– 65	6	40	6	40
	e. 66 - 75	5	33.3	1	6.7
2	**Sex**				
	a. Male	9	60	10	66.7
	b. Female	6	40	5	33.3
3	**Education**				
	a. Illiterate	1	6.7	-	-
	b.School Education	6	40	9	60
	c. Graduate	7	46.7	6	40
	d. Post-Graduate	1	6.7	-	-
4	**Occupation**				
	a. Unemployed	4	26.7	5	33.3
	b. Professional	3	20	3	20
	c. Non-professional	6	40	4	26.7
	d. Retired	2	13.3	3	20.7
5	**Marital status**				
	a. Single	1	6.7	1	6.7
	b. Married	14	93.3	14	93.3
6	**Type of family**				
	a. Joint Family	3	20	3	20
	b. Nuclear Family	12	80	12	80

The frequency and percentage distribution of selected demographic and clinical variables of patients in the interventional and non-interventional groups is depicted in table 1. Out of the different age groups analyzed, a maximum of six (40%) patients belonged to the age group 50 to 65 years, both in the interventional group and non-interventional group. When sex was considered, males were dominant 10 (66.7%) compared to females 5 (33.33%) in the non-interventional group, and similarly there were nine (60%) male patients in the interventional group. In the aspect of educational status, a maximum of six (40%) patients in the study group and nine (60%) patients in the non-interventional group had school-level education.

When samples were analyzed regarding their occupation, six (40%) patients in the study group were non-professionals and five (33.33%) patients in the non-interventional group were unemployed. In the aspect of marital status, 14 (93.3%) patients in both the interventional group and non-interventional group were married.

Concerning the type of family, a maximum of 12 (80%) patients in both the groups belonged to nuclear families.

Table 2: Frequency and percentage distribution of patients according to the clinical variables among the interventional and non-interventional group (N=30)

Sl. No	Clinical variables	Interventional group		Non-interventional group	
		(n=15)	%	(n=15)	%
1	**Diagnosis**				
	a. Respiratory Illness	5	33.3	3	20
	b. Post-operative status	6	40	5	33.3
	c. Renal & nephrology cause	3	20	2	13.3
	d. Any others	1	6.7	5	33.3
2	**Period of ventilation**				
	a. Two to five days	10	66.7	13	86.7
	b. Six to nine days	5	33.3	1	6.7
	c. Ten to fourteen days	-	-	1	6.7
3	**Duration of ICU stays**				
	a. Two to five days	2	13.3	4	26.7
	b. Six to nine days	10	66.7	10	66.7
	c. Ten to fourteen days	3	20.7	-	-
	d. More than 2 weeks	-	-	1	6.7
4	**Indication for intubation**				
	a. Metabolic abnormalities	3	20	3	20
	b. Post-operative status	5	33.3	4	23.3
	c. Unstable hemodynamic	7	46.7	8	56.7

Among the clinical variables, regarding the admission diagnosis, 6 (40%) patients in the interventional group and five (33.3%) patients in the non-interventional group were in the post-operative status.

Regarding the period of ventilation, 13 (86.7%) patients in the non-interventional group and 10 (66.7%) patients in the study group were ventilated for two to five days.

In both the interventional group and non-interventional group, 10 (66.7%) patients had ICU stay of six to nine days. Concerning indication for intubation, eight (53.3%) patients in the non-interventional group and seven (46.7%) patients in the interventional group were intubated for the indication of unstable hemodynamics.

Table 3: Frequency and percentage distribution of level of self-care abilities among patients up to five days after weaning (N=30)

Sl. No	Day of observation	Level of self-care abilities	Interventional group (n=15)	%	Non-Interventional group (n=15)	%
1	Pre Test	Dependant	15	100	15	100
2	Post Test Day I	Dependant	15	100	15	100
3	Post Test Day 2	Dependant	13	86.7	14	93.3
		Partially Dependant	2	13.3	1	6.7
4	Post Test Day 3	Dependant	2	13.3	8	53.3
		Partially Dependant	11	73.3	7	46.7
		Independent	2	13.3	-	-
5	Post test Day 4	Partially Dependant	8	53.3	14	93.3
		Independent	7	46.7	1	6.7
6	Post test Day 5	Partially Dependant	1	6.7	9	60
		Independent	14	93.3	6	40

Table 3 shows the distribution of the level of self-care abilities among patients weaned from the ventilator in the interventional group and non-interventional group. On day two, out of 15 patients in the interventional group, 13 (86.7%) patients were dependant, two (13.3%) of them were partially dependant in their level of self care abilities. However, in the non-interventional group, out of 15, 14 (93.7%) patients were dependant and one (6.3%) was partially dependant in their level of self care abilities.

When analyzing the data on day three, out of 15 patients in the interventional group, two (13.3%) patients were dependant, 11 (73.3%) were partially dependant and two (13.3%) were independent in meeting their self care. Out of 15 in the non-interventional group, eight (53.3%) were dependant, seven (46.7%) were partially dependant in their level of self care abilities.

While analyzing on day four, out of 15 patients in the interventional group, eight (53.3%) were partially dependant and seven (46.7%) were independent. In the non-interventional group, out of 15, 14 (93.7%) patients were partially dependant, one (6.3%) was independent in meeting their self care.

On day five, out of 15 patients in the interventional group, 14 (93.3%) patients were independent and one (6.7%) was partially dependant. Out of 15 patients in the non-interventional group, nine (60%) were partially dependant, six (40%) were independent in meeting their self care abilities.

Table 4: Mean, Standard deviation and Mann-Whitney test values (non parametric test) of self care abilities among patients between the pre test and post test for five days after weaning from ventilator within the interventional group and non-interventional group (N=30)

Sl. No	Between the days after extubation	Interventional group Mean	S.D	Mann-Whitney test	Non-Interventional group Mean	S.D	Mann-Whitney test
1	Pre test- Post test day 1	3.00 3.33	4.551 5.233	1.000	2.67 2.67	5.300 5.300	.000
2	Pre test – Post test day 2	3.00 16.33	4.551 14.201	3.192 ***	2.67 6.33	5.300 8.121	2.209 *
3	Pre test – Post test day 3	3.00 38.33	4.551 12.771	3.433 ***	2.67 26.67	5.300 11.127	3.417 ***
4	Pre test – Post test day 4	3.00 51.3	4.551 10.933	3.420 ***	2.67 42.67	5.300 5.936	3.447 ***
5	Pre test – Post test day 5	3.00 63.33	4.551 8.165	3.432 ***	2.67 51.00	5.300 8.062	3.438 ***

*** p <0.001,*p <0.05.

Table 4 reveals the effect of ambulation up to five days in the interventional and non-interventional group. The mean score in level of self care abilities in the interventional group was 3.33 with the standard deviation of 5.233 on the first day of observation. Whereas in the non-interventional group, the mean score was 2.67 with the standard deviation of 5.300. There was no statistical significant improvement in their level of self care abilities in both the groups on the first day of observation.

On the second day, the mean score was 16.33 with the standard deviation of 14.201 in the interventional group. The Mann-Whitney test showed a statistically significant improvement in their level of self care abilities at p <0.001. In the non-interventional group, the mean score was 6.33 with the standard deviation of 8.121. Even though there was an improvement in the level of self care abilities, it was minimal, as evidenced by the Mann-Whitney test indicating significance at p <0.05.

Likewise on the third day, further improvement in the level of self care abilities was noticed in the interventional group than the non-interventional group. The mean score was 38.33 with the standard deviation of 12.771 in the interventional group. The Mann-Whitney test showed a statistically significant improvement in their level of self care abilities at p <0.001. In the non-interventional group, the mean score of 26.67 with the standard deviation of 11.127 was observed, and the Mann-Whitney test was significant at p <0.001.

On the fifth day, the level of self care abilities was much better noticed in the interventional group than the non-interventional group. Even though the Mann-Whitney test showed a statistical significance at p <0.001, the mean score was 63.33 with the standard deviation of 8.165 in the interventional group and in the non-interventional group, the mean score was 51 with the standard deviation of 8.062. The changes in the mean scores and the standard deviation values in between the interventional group and non-interventional group on the third, fourth, and fifth day of observation clearly shows that the ambulation after weaning from the ventilator has improved the level of self care abilities.

Table 5: Mean,standard deviation and Mann-Whitney test values (non parametric test) of self care abilities among patients between the pre test and post test for five days after weaning from the ventilator (N=30)

Sl. No	Between the days after weaning	Interventional group		Non-Interventional group		Mann-Whitney test
		Mean	SD	Mean	SD	
1	Pre test	3.00	4.551	2.67	5.300	679
2	Post test day 1	3.33	5.233	2.67	5.300	.679
3	Post test day 2	16.33	14.201	6.33	8.121	.021*
4	Post test day 3	38.33	12.771	26.67	11.127	.021*
5	Post test day 4	51.33	10.933	42.67	5.936	.025*
6	Post test day 5	63.33	8.165	51.00	8.062	.001***

***p <0.001,*p <0.05

Table 5 depicts the effect of ambulation on level of self care abilities among patients after weaning from the ventilator by comparing the interventional group and non-interventional group in the pre test and post test. There was no significant improvement in their level of self care abilities in the pre test, even though the mean scores were more (3.00) in the interventional group than the non-inteventional group (2.67). On the first day, the mean score of self care abilities in the interventional group was 3.33 with the standard deviation of 5.233. Similarly the mean score was 2.67 in the non-interventional group with a standard deviation of 5.300, showing no significant improvement in their level of self care abilities.

The mean score of level of self care abilities in the interventional group was 16.33 with the standard deviation of 14.201 on the second day of observation. In the non-interventional group, mean score was 6.33 with the standard deviation of 8.121. Mann-whitney test revealed a statistical significant improvement in the level of self care abilities in the interventional group compared to non-interventional group (p <0.05).

Similarly, on the third day, the data revealed a significant improvement in the level of self care abilities in the interventional group with a mean score of 38.33 and a standard deviation of 26.67. The non-interventional group mean score was 26.67 with a standard deviation

of 11.127. Mann-Whitney test revealed a statistical significant improvement in the level of self care abilities in the study group (p <0.05).

On the fifth day, a drastic improvement in the level of self care abilities in the interventional group was observed, with the mean score of 63.33 and standard deviation 8.165, while in the non-interventional group the mean score was 51.00 with a standard deviation of 8.062. Mann-Whitney test revealed a statistical significant improvement in the level of self care abilities in the interventional group compared to the non-interventional group (p <0.001).

Discussion

The study findings were discussed based on the objectives as follows:

The first objective was to assess the level of self care abilities of patients who were weaned from the ventilator in the interventional and non-interventional groups

The percentage distribution of level of self care abilities among patients after weaning from the mechanical ventilator revealed that 15 (100%) patients were dependant in their self care abilities in both the groups, immediately after weaning from the ventilator and also on the first day of observation.

There was an improvement in the patient's level of self care abilities on the third day of observation in the interventional group. Two (13.3%) patients were independent, 11 (73.3%) patients were partially dependant and only two (13.3%) patients were dependant. Whereas in the non-interventional group, only seven (46.7%) patients were in the partially dependant stage and a majority (8; 53.3%) of patients were still in the dependant stage.

On the last day of observation, 14 (93.3%) patients in the interventional group were independent in their level of self care abilities, while only one (6.7%) patient was partially dependant. However in the non-interventional group, majority of the patients (9; 60%) were still in the partially dependant stage and only six (40%) patients were in the independent stage. This shows a significant improvement in the level of self care abilities in the interventional group than the non-interventional group.

A study was conducted to evaluate the hospital mortality and health status in 124 post abdominal surgery patients after a period of prolonged mechanical ventilation. All the patients were receiving > or = 7 days of mechanical ventilation in an University affiliated territory medical hospital. The study was done by retrospective chart reviews and prospective patient interviews. It was observed that few patients had limitations in their activities of daily living (eating, dressing, bathing) and most of them had limitations of moderate activity and vigorous activity.[9]

The second objective was to assess the effectiveness of ambulation on level of self care abilities among patients who were weaned from ventilator

In assessing the effectiveness of ambulation on level of self care abilities among patients in interventional and non-interventional groups using (non parametric test) Mann-Whitney test, it was observed that in the interventional group the level of self care abilities showed a marked improvement on all the five days of observation.

There was no significant improvement in the level of self care abilities between pre test and the first day of observation in both interventional and non-interventional groups. But on the second, third and fourth days of observation, a significant improvement in the level of self care abilities in the interventional group was observed compared to the non-interventional group. Mann-Whitney test revealed a statistical significant improvement at the level p <0.05.

On the fifth day, the data revealed a drastic improvement in the levels of self care abilities of the interventional group when compared to the non-interventional group. Mann-Whitney test revealed a statistical significant improvement at the level p <0.001.

A study was conducted to determine the effect of pulmonary rehabilitation on some physiologic variables in chronic obstructive pulmonary disease (COPD) patients recovering from an episode of respiratory failure in respiratory ICU. Eight COPD patients were studied using prospective randomized study. The rehabilitation consisted of passive mobilization, early ambulation, lower skeletal muscle training. All the patients regained the ability to walk and thus the six minutes walking distance had significant improvement (p <.001).[10] It was identified that most patients who required mechanical ventilation were benefited from comprehensive early pulmonary rehabilitation.

The effect of intervention on self care abilities was compared between the pre test and post test values up to five days for both the interventional and non-interventional groups. On the first day, the mean score of self care abilities in the interventional group was 3.33 with a standard deviation of 5.233. Whereas in

the non-interventional group, the mean score was 2.67 with a standard deviation of 5.3. There was no statistical significant improvement in their level of self care abilities in both the groups on the first day of observation.

Likewise on the third day, further improvement in the level of self care abilities was noticed in the interventional group than the non-interventional group. The mean score was 38.33 with the standard deviation of 12.771 in the interventional group. The Mann-whitney test showed a statistical significant improvement in their level of self care abilities with p <0.001. In the non-interventional group, the mean score was 26.67 with the standard deviation of 11.127 and the Mann-whitney test was significant with p <0.001.

On the fifth day of observation, the level of self care abilities was much better in the interventional group than the non-interventional group, even though the Mann-whitney test showed statistically significance at p <0.001 in both the groups. The mean score was 63.33 with a standard deviation of 8.165 in the interventional group and the mean score was 51 with a standard deviation of 8.062 in the non-interventional group.

The changes in the mean scores and the standard deviation values in the interventional group and non-interventional group on the third and fifth day of observation clearly shows that ambulation after weaning from the ventilator had improved the level of self care abilities of patients in the interventional group.

The third objective was to associate the level of self care abilities of patients with the selected demographic and clinical variables

There was no significant association of any demographic variable with the level of self care abilities of patients in the interventional group on the second day of observation. A significant association of the level of self care abilities with clinical variables such as admission, diagnosis and duration of ICU stay on the second day of observation in the interventional group was observed.

A study was conducted to evaluate the functional status of patients after discharge from ICU and to identify predictors and explanatory factors of functional status. This prospective observational cohort study was done between 3-7 days after ICU discharge. It was reported that the overall functional status was poor (median Barthel index 6) and their ability to perform basic activities of daily living, duration of dependency on the ventilator was associated with functional status after ICU discharge. It was concluded that in the first

week after discharge from the ICU, majority of patients had substantial functional disabilities in the ADL, as experienced while on ventilation.[1]

Conclusion

Practicing ambulation after weaning from the ventilator was found to be effective. There was a statistical significant improvement (p <0.001) in the level of self care abilities within the interventional group, between the pre test and post test values on the second, third, fourth and fifth days of observation. There was a significant improvement in the level of self care abilities in between the interventional and non-interventional groups on the second, third and fourth days of observation (p<0.05). There was a significant improvement in the level of self care abilities in between the interventional and non-interventional groups on the fifth day of observation with p <0.001.

Nurses predominantly play a vital role as primary caregivers in the intensive care unit for patients treated with mechanical ventilator. The nurses taking care of such patients are aware of the delay the patient experiences in becoming independent in their self care abilities, since they spend significant time with the patient. Hence nurses have to practice ambulation for such patients, so as to help them improve their self care abilities after weaning from the ventilator.

Conflicts of Interest
Nil

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