

## Original Article

# Leukapheresis in Patients with Hematologic Malignancies

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**Abstract :** *Leukapheresis procedures had been performed in 4 patients with hematologic malignancies to reduce complication of leukostasis and tumor lysis syndrome due to intensive chemotherapy. An average of 6.5 (range 5.4-7) liter of blood was processed per leukapheresis before a course of chemotherapy. Mean reduction of white blood cell count was 43.25%. All of the patients undergoing leukapheresis were well tolerated. Leukapheresis can be performed effectively and conveniently in these patients.*

**Key Words :** ● Leukapheresis ● Leukostasis ● Tumor lysis syndrome ● Leukemia

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Leukemic patients presenting with hyperleukocytosis may develop complications related to accumulation of leukemic cells. They are at risk of the leukostasis syndrome, a life-threatening syndrome caused by occlusion of small arteries by aggregates of blast cells in cerebral and pulmonary vasculature. They develop rapidly progressive neurologic and pulmonary manifestations such as visual blurring, retinal haemorrhage, Intracerebral haemorrhage, dyspnea, hypoxia, bilateral pulmonary infiltration, etc. Furthermore, they are associated with early metabolic complication secondary to rapid

blast cell lysis after chemotherapy<sup>6</sup>.

Various modalities have been advocated for preventing the serious consequences such as immediate cranial radiation, cytoreduction by exchange transfusion and leukapheresis, but they are not universally accepted practice. Leukapheresis has been shown in previous reports to be rapid, safe and most effective for cytoreduction<sup>1-6</sup>. Therefore, we studied leukemic patients with hyperleukocytosis who underwent leukapheresis in order to evaluate the usefulness of this procedure before initiation of chemotherapy.

## Materials and Methods

Four leukemic patients who had initial leukocyte count over  $100 \times 10^9/L$  with symptoms

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and signs of leukostasis underwent leukapheresis. Fenwal 3,000 plus blood cell separator was used to process 1-2 patients' whole blood volume with the whole blood flow rate of 50-60 ml/min. Whole blood volume ranged from 5.4 to 7 liter were processed over a period of 2-3 hours. Acid citrate dextrose (ACD-A) was used as anticoagulant. The ratio of ACD-A to the whole blood was 1:11. Withdrawal was through 16-gauge needles and infusion through 16-18 gauge needles. Hydration, alkalinization and allopurinol administration were instituted in all patients. Complete blood count, serum calcium, potassium, phosphorous and uric acid were determined before and after each procedure.

### Results

The patients' characteristics, presenting symptoms and signs attributable to leukostasis are shown in tables 1 and 2. A mean of 43.25% reduction in circulating leukocytes was achieved in four patients with a mean initial leukocyte count of  $247 \times 10^9/L$  (range 112 to  $429 \times 10^9/L$ ) as shown in table 3.

There was no complication associated with leukapheresis. Neurologic and respiratory symptoms from leukostasis clinically improved

**Table 1** Characteristics of patients with hyperleukocytosis

Characteristics	No. of Patients
<i>Sex</i>	
Male	1
Female	3
<i>Age (years)</i>	
Mean	28.25
Range	17-49
<i>Leukemia</i>	
M4	2
M5	1
CML with blastic crisis	1

**Table 2** Symptoms and signs prior to cytoreduction

Symptoms and signs	No. of patients
Visual blurring	1
Retinal hemorrhage	3
Bilateral pulmonary infiltration	1

**Table 3** Hematologic findings after leukapheresis

Patient	Percent	
	WBC reduction	Platelet reduction
Case 1	76.81	31.03
Case 2	30.77	12.6
Case 3	51.03	16.7
Case 4	14.37	19.04
Mean (range)	43.25 (14.37-76.81)	21.34 (12.6-31.03)

following cytoreduction. There was no evidence of tumor lysis effects (hyperkalemia, hyperphosphatemia, hyperuricemia and hypocalcemia) in three patients. One of the patients had an evidence of mild electrolyte abnormalities without clinical symptoms.

### Discussion

The use of cytoreduction to reduce complications of leukostasis and tumor lysis syndrome is controversial. Brain radiation is of doubtful benefit. Exchange transfusion increases the potential risk of transfusion associated infectious diseases. Leukapheresis is recommended because it can rapidly and safely performed. The risk of leukostasis is greater in myelogenous than lymphocytic leukemia because myeloblasts are hyperviscous and their larger size can increase the risk of vascular damage<sup>6-7</sup>. Because the impact of leukapheresis on leukocyte is transient, it must be immediately followed by chemotherapy. In this study, the mean leukocyte reduction (43.25%) in four patients with myelogenous leukemia are consistent with results from other reports (20-60%).<sup>1-5</sup> We believed that the patients appeared to benefit from emergent leukapheresis because all of them clinically improved from pulmonary and neurologic symptoms.

Leukocyte reduction also attenuates the risk of tumor lysis syndrome (spontaneous or therapy induced). These metabolic disorders resulting from rapid blast cell lysis and massive release of intracellular potassium, phosphate, uric acid into vascular compartment can cause

depositions of urate crystal and calcium phosphate in tubule lumens with resultant renal failure<sup>7,8</sup>. Only one patient in our study had mild increased level of uric acid, phosphate, and potassium with normal level of BUN and creatinine two days after chemotherapy. The result suggests that leukapheresis is of benefit in decreasing the incidence of electrolyte abnormalities.

### Conclusion

Leukapheresis is considered as one of appropriate temporary therapies for patients with myelogenous leukemia presented with hyperleukocytosis (leukocyte count over  $100 \times 10^9/L$ ). The procedure can be performed safely and effectively to lessen the risk of leukostasis and tumor lysis syndrome before the initiation of chemotherapy.

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## การรักษาผู้ป่วยมะเร็งเม็ดโลหิตขาว โดยวิธี Leukapheresis

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**บทคัดย่อ :** คณะผู้วิจัยได้ทำการรักษาผู้ป่วยโรคมะเร็งเม็ดโลหิตขาว จำนวน 4 ราย ซึ่งมีภาวะเม็ดเลือดขาวสูงและเกิด Leukostasis โดยวิธี Leukapheresis เพื่อลดการเกิดภาวะแทรกซ้อนของ Leukostasis และลดการเกิด tumor lysis syndrome หลังได้รับการรักษาโดยวิธีเคมีบำบัดเลือดรวมของผู้ป่วย จำนวน 5.4-7 ลิตร (ค่าเฉลี่ย = 6.5) จะถูกผ่านเข้าเครื่อง cell separator เพื่อเก็บเฉพาะเม็ดโลหิตขาวก่อนที่ผู้ป่วยจะได้รับเคมีบำบัด ค่าเฉลี่ยของเม็ดโลหิตขาวที่ลดลงในกระแสโลหิตของผู้ป่วย = 43.25% ไม่มีผู้ป่วยรายใดที่ได้รับการรักษาโดยวิธีนี้ มีภาวะแทรกซ้อนเกิดขึ้น

**Key Words :** ● Leukapheresis ● Leukostasis ● Tumor lysis syndrome ● Leukemia

วารสารโลหิตวิทยาและเวชศาสตร์บริการโลหิต 2541;8:239-42.