Table S1. Probes used in this work.

| Manufacturer                      | Name               | Target                  | Dye Color | Catalog number | Use in figure |
|-----------------------------------|--------------------|-------------------------|-----------|----------------|---------------|
| Beijing Jinpujia Medical Technology Co., Ltd. | GLP 13 / 21       | 13q14/21q22             | G/ R      | F01001         |               |
|                                   | GLP P53 / 1q21     | 17p13.1/1q21            | G/R       | F01003/F01003  | Figure S3 E   |
|                                   | GLP IGH            | 14q32                   | R/ G      | F01003         | Figure S3C    |
|                                   | GLP C-MYC          | 8q24                    | R/G       | F04016M        | Figure 2 D    |
|                                   | GLP BCR / ABL      | 22q11/9q34              | G/ R      | F01005         | Figure S4 C/  
|                                   |                    |                         |           |                | Figure S7 C   |
|                                   | GLP TEL / AML1     | 12p13/21q22             | R/ G      | F01036         | Figure 2 E    |
|                                   | GLP MLL            | 11q23                   | G/ R      | F01036         | Figure 3 B    |
|                                   | GLP D7S486 / CSP7  | 7q31/7p11-q11           | R/G       | F01032         | Figure S7 D   |
|                                   | CSP X / Y          | Xp11.1-q11.1/          | G/ R      | F01006         |               |
|                                   |                    | Yp11.1-q11.1           |           |                |               |
|                                   | GLP PML / RARA     | 15q22/17q21             | G/ R      | F01023         | Figure S8 B   |
|                                   | GLP AML1 / ETO     | 21q22/8q22              | G/ R      | F01025         | Figure 2 C/  
|                                   |                    |                         |           |                | Figure S2 C   |
|                                   | GLP IGH / CCND1    | 14q32/11q13             | G/ R      | F01019         |               |
|                                   | GLP BCL6           | 3q27                    | R/ G      | F04011M        |               |
|                                   | CSP 3 / CSP 7      | 3p11.1-q11.1/7p11.1-q11 | R/G       | F01008         |               |
|                                   | GLP D20S108 / CSP8 | 20q12/8p11-q11          | R/G       | F01032         |               |
|                                   | GLP CSF1R / D5S23  | 5q33/5p15               | R/G       | F01032         |               |
|                                   | D5S721             |                         |           |                |               |
|                                   | GLP p16 / CSP 17   | 9p21/17p11.1-q11.1      | R/ G      | F01008         | Figure S4 B   |
| Guangzhou Anbiping Pharmaceutical Technology Co., Ltd. | GSP IGH / CCND3   | 6p21/14q32              | G/R       | F.01123-01     | Figure S3 D   |
|                                   | GSP EWSR1          | 22q12                   | G/R       | F.01194-0      | Figure S2 B   |
|                                   | GSP PDGFRB         | 5q32                    | G/R       | F.01033-01     |               |
|                                   | GSP TCF3 / PBX1    | 1q23/19p13              | R/G       | F.01095-01     |               |
Table S2: Results of FISH signals were quantified by image cytometry in 10 patients (19 probes).

| case | GLP | GLP | p16 | CSP | 3 | / | GLP | GLP | IGH | / | GLP | BCR | GLP | GLP | GLP | TEL | GLP | AML1 | GLP | PML | GSP | GSP | GSP | IGH | GSP | TCF3 | /
|------|-----|-----|-----|-----|----|---|-----|-----|-----|---|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|
|      | PS3| /CSP| 17%( |     |   | / |   |    |     |   |    |      |     |     |     |     |     |     |    |    |     |     |     |     |    |     |     |     |     |     |     |
|     | (%) |     |     |     |   |   |    |      |     |   |    |     |      |     |     |     |     |     |     |    |    |     |     |     |     |    |     |     |     |     |     |     |
| 1   | 2G4O(40) | 4G3O(37) | 4G4O(27) | 4G4O(40) | 2G2O(5) | 3F(38) | 3G4O(38) | 4G3O(36) | 2F(60) | 2F(60) | 4G4O(40) | 4G4O(22) | 4F(38) | 4G4O(34) | 4G4O(39) | 4F(37) | 2F(66) | 3G3O(40) | 4G4O(34) |     |     |     |     |     |     |     |
| 2G2O(60) | 2G2O(63) | 2G2O(73) | 2G2O(60) | 2G1O(36) | 4F(5) | 3G3O(6) | 2G2O(64) | 3F(4) | 3F(23) | 2G2O(60) | 4G5O(12) | 2F(62) | 4G5O(5) | 2G2O(61) | 2F(63) | 3F(18) | 2G2O(60) | 4G5O(6) |     |     |     |     |     |     |     |
| 1G1O(59) | 2G2O(56) | F(30) | 4F(17) | 2G2O(61) | 4F(6) | 2G2O(61) | 5F(6) |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |
| 1. 2G4O(88) | 2G3O(90) | 2G2O(100) | 2G4O(76) | 2G1O(80) | 2F(15) | 4G3O(78) | 4G3O(85) | 6F(80) | 2F(100) | 2G2O(10) | 4G4O(85) | 2F(20) | 4G6O(87) | 4G4O(85) | 2F(13) | 4F(88) | 4G4O(93) | 2G4O(84) |     |     |     |     |     |     |     |
| 2G3O(4) | 2G2O(10) |     | 2G2O(24) | 1G1O(10) | 4F(85) | 4G4O(13) | 4G4O(5) | 3F(4) | 0 | 2G2O(5) | 3F(80) | 4G4O(5) | 2G2O(15) | 4F(87) | 4F(87) | 2G2O(7) | 2G2O(16) |     |     |     |     |     |     |     |
| 2G2O(8) |     | 2G2O(10) |     | 2G2O(9) | 2G2O(10) | 2F(6) |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |
| 3 1. 2G4O(50) | 4G3O(47) | 4G4O(85), | 4G3O(75) | 2F2G2 | 6G4O(50) | 4G4O(20) | 2F(16) | 2F(21) | 4G4O | 4G4O(10) | 2F(20) | 3G3O(70) | 4G4O(76) | 4F(80) | 2F(31) | 5G4O(18) | 4G4O(78) |     |     |     |     |     |     |     |
| 3G5O(20) | 2G1O(5) | (89) | 2G2O(15) | 2G2O(15) | 8F(5) | 5G4O(28) | 4G3O(60) | 3F(84) | 4F(70) | (81) | 3G4O(70) | 4G4O(80) | 4G4O(6) | 2G2O(24) | 2F(10) | 4F(53) | 4G4O(11) | 2G2O(22) |     |     |     |     |     |     |     |
| 4G4O(6) | 2G1O(18) | 2G2O(11) |     | 1F2O2 | 4G4O(10) | 2G2O(20) | 5F(9) | 2G2O(19) | 4G5O(4) | 2. F(15) | 2G2O(24) | 2. | 5F(16) | 2G2O(11) |     |     |     |     |     |     |     |
| 2G2O(22) |     | 2. 2. | 2. | 2. | G(30) | 2G2O(12) | 2. | 2. | 2G2O(16) | 4F(85) | 2. | 2F(87) | 2. |     |     |     |     |     |     |     |     |     |     |     |
| 4G(77) | 4G4O | 4G4O(85), | 4G4(85) | 2G2O |     | 4F(90) | 4G4O(78) |     | 4G4O(78) | 2G4O(30) | 4G4O(80) | 2F(13) | 2F(47) | 2. | 4G4O(78) |     |     |     |     |     |     |     |
| 2. 2G1O(5) | (89) | 2G2O(15) | 2G2O(20) | (15) | 6G4O(63) | 4G4O(20) | 2F(16) | 2F(10) | 2G2O(22) | 2. | 4G4O(70) | 2G2O(20) | 4F(27) | 6G4O(60) | 2G2O(22) |     |     |     |     |     |     |     |
| 3G5O(8) | 2G1O(8) | 2G2O(10) |     | 2. | 4G4O(20) | 4G3O(60) | 3F(84) |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |
| 3G4O(62) | 2F2G2 | 2G2O(17) | 2G2O(20) |     | 4G5O(2) |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |
| 4G4O(8) | 2G2O(22) | F2G2G(4) |     | 2G2O(18) |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |
**Note:** 1 = At diagnosis; 2 = At relapse

**Abbreviation:**  G = green signal; O = red signal; M = multiple signals; F = yellow signal.
Table S3: Main Characteristics of Patients with AML with ins (21;8).

| Case | Age/Sex | FAB | Cytogenetic analysis | Revised cytogenetic result following FISH | Response | Reference |
|------|---------|-----|----------------------|------------------------------------------|----------|-----------|
| 1    | 2.9/F   | M2  | 45,X,-X              | 45,X,-X,der(7)t(7;8)(q34;q24),ins(21;8)(q22;q22q22) | CCR      | Gamerdinger et al., 2003 |
| 2    | 12.2/M  | M1  | 47,XY,+8/46,XY       | 46,XY,ins(21;8)(q22;q22q22)/47,XY,+8,ins(21;8)(q22;q22q22) | CR       |          |
| 3    | 3.8/F   | M1  | 47,XX,der(3)(3;?8)(q27;?q13),der(21)(8;21)(q22;22q22),+?der(21)(8;21)(q22;22q22) | 47,XX,der(3)(3;8)(q29;13)del(8)(q21q22),+8,der(8)t(3;8)(q21q22) | CCR      |          |
| 4    | 43/M    | M2  | 45,X,-Y              | 45,X,-Y,ins(21;8)(q22;q22q22)              | CR       | Onozawa et al., 2003 |
| 5    | 73/F    | M2  | 46,XX,ins(21;8)(q12;q13q22) | 46,XX,ins(21;8)(q12;q13q22) | CR       | Yamazaki et al., 2000 |
| 6    | 37/M    | M2  | 46,XY,ins(21;8)(q22;q21q22) | 46,XY,ins(21;8)(q22;q21q22) | NA       | Harrison et al., 1999 |
| 7    | NA      | M2  | ins(21;8),del(8)a     | ins(21;8)a                               | NA       | Kazama et al., 1996 |
| 8    | 48/F    | M2  | NA                   | 46,XX,ins(21;8)(q22;q21q22) | CR       |          |
| 9    | 10/F    | M2  | 46,XX[20]            | 46,XX,ins(21;8)(q22;q21q22) | CR       |          |
| 10   | 43/M    | M2  | 46,XY[1]/46,XY,t(8;21)(q22;q22)[14] | 46,XY,ins(21;8)(q22;q11q22) | CR       | Giorgina Specchia, et al., 2004 |
| 11   | 54/M    | M2  | 46,XY[20]            | 46,XY,ins(21;8)(q22;q21q22) | CCR      |          |
| 12   | 19/F    | M2  | 46,XY[20]            | 46,XX,ins(21;8)(q22;q13q22) | CR       |          |
| 13   | 48/M    | M2  | 47,XY,+8[22]         | 47,XY,p8,ins(21;8)(q22;q22q22)            | ED       | Frank G, et al., 2011 |
| 14   | 47/M    | M2  | 45,X, - Y,t(8;21)(q22;q22)[20]. | 45,X, - Y, der(8)inv(8)(q22q24.1)ins(21;8)(q22;q12q22),der(21)ins(21;8)(q22;q12q22) | CR       | Jae-Hee Lee, et al., 2014 |
| 15   | 23/M    | M2  | 92,XXYY,t(8;21)(q22;q21)X2[8]/46,t(8;21)(q22;21)[12] | 92,XXYY,ins(21;8)(q22;q24;q22) | R        | In our present case |

Note:  
*: Partial cytogenetic data are available.  
$: CR = complete remission;  
Abbreviation:  
CCR = continuous complete remission;  
R = Relapse;